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Report to Umsunguli Project Management on a Geotechnical Investigation carried out for the Proposed Mount Verde Development, Hilton, KwaZulu-Natal

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Report to Umsunguli Project Management on a Geotechnical Investigation carried out for the Proposed Mount Verde Development, Hilton, KwaZulu-Natal

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DATE:	**June 2022**	**June 2022**
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SIGNATURE:		

Report to Umsunguli Project Management on a Geotechnical Investigation carried out for the Proposed Mount Verde Development, Hilton, KwaZulu-Natal

1. INTRODUCTION AND TERMS OF REFERENCE

Gondwana Geo Solutions (Pty) Ltd, or GGS, were requested by Mr Durell Barnabas of Umsunguli Project Management to provide a proposal to undertake a geotechnical investigation for the proposed new Mount Verde Development in Hilton, KwaZulu-Natal. GGS were subsequently appointed by Mr Jannie Cronje of Umsunguli Project Management to proceed with the work.

This report contains the findings of the geotechnical investigation. The results of the test pits, hand augered boreholes, dynamic cone penetrometer tests and laboratory test results are presented.

Recommendations are provided for excavation requirements, general earthworks, foundations, groundwater, materials usage and subgrade treatment for roads.

2. INFORMATION SUPPLIED

The following information was made available in electronic format for the geotechnical investigation:

- PDF file title *"001"* showing the Mount Verde Forest Village area
- PDF file title *"002"* showing the Commercial Area
- PDF file title *"003"* showing both the Forest Village and Commercial Area

3. SITE DESCRIPTION

The general site is situated at Mount Verde along Voigts Crescent in Hilton, KwaZulu-Natal. It can be accessed by entering the main east gates at Mount Verde and following Voigts Crescent for 1.20km before encountering the existing workshop on the left.

3.1 Proposed Forest Village

The Forest Village area can be accessed by taking the adjacent road to the northeast for about 400m and taking a left onto the dirt road that leads to the Forest Village area. The proposed housing development is located near the existing foundations present adjacent to the dirt road.

The site initially dips moderately towards the north along the first segment of the dirt road, which becomes more gently sloping. Along the western edge of the site the topography becomes moderately to steeply sloping towards the west. Towards the northern boundary the site undulates as well as generally dipping gently to moderately towards the west, becoming steeper towards the west.

The site is bounded by adjacent farmland to the east, and to the west by the site boundary.

Vegetation comprises mostly of short-lying grasses with trees sparsely clustered throughout the site.

The general layout of the Forest Village site is shown in Figure 1 Site Plan below.

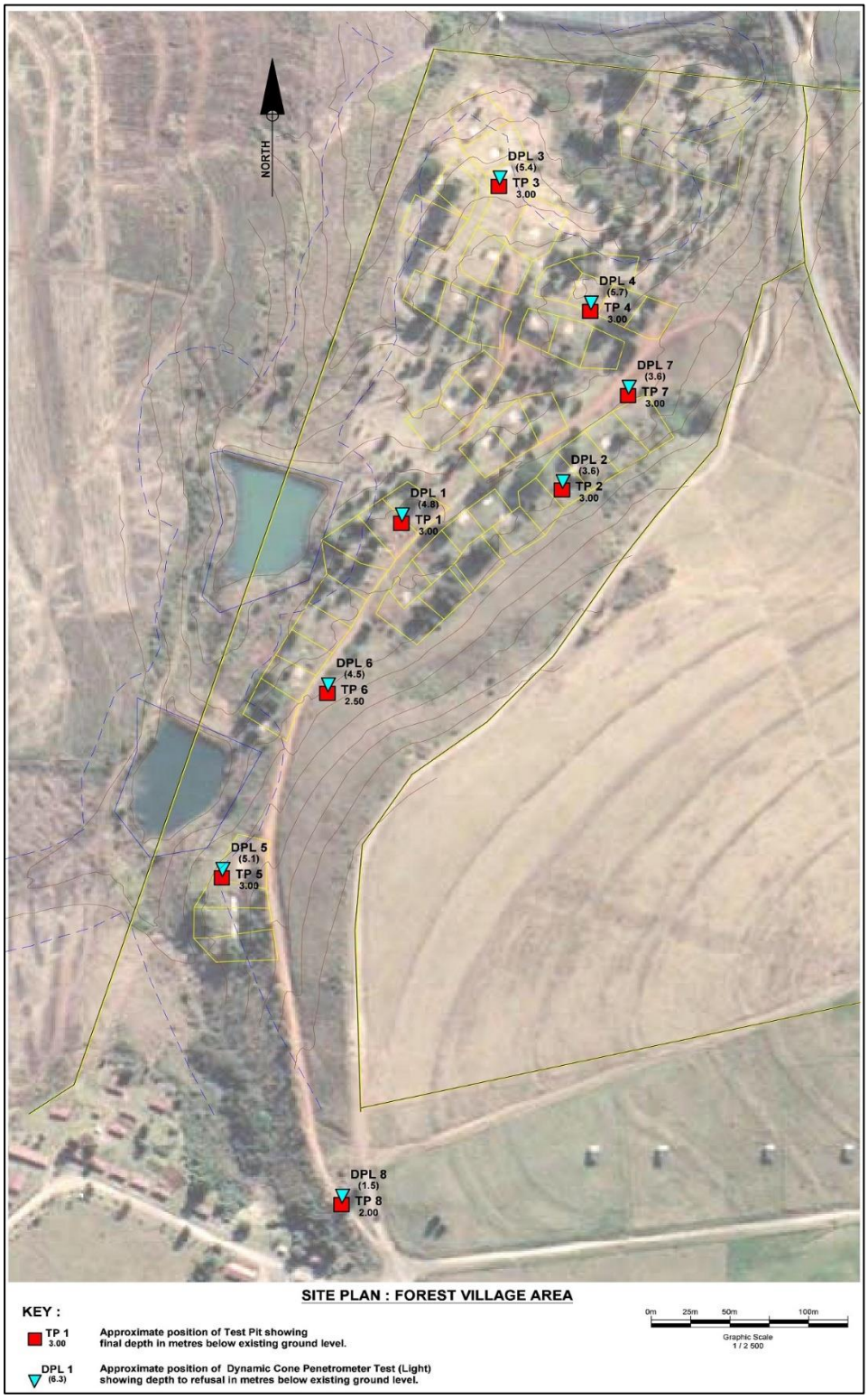


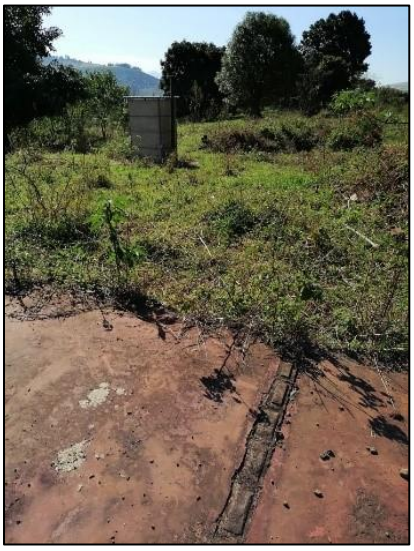
Figure 1: Site Plan showing test pit and DPL test positions in the Forest Village Area

The following plates provide a more detailed perspective of the site.

Plates 1 & 2: Dirt road accessed leading to the Forest Village area

Plates 3 & 4: View towards the east (left) and to the north (right) of the Forest Village area

Plates 5 & 6: Vegetation on the site comprises short-lying grasses and trees in clusters




Plates 7 to 10: Partly demolished farmhouses encountered at the Forest Village site

3.2 Proposed Commercial Area

The proposed commercial area is situated at the existing offices and workshop area.

Topographically, the site is relatively flat becoming gently sloping towards the north. Further north beyond the site boundary the site becomes more moderately sloping.

The site is bounded to the south by Voigts Crescent and to the north by an existing access road which leads west to Voigts Crescent or east to the Forest Village area.

The site is lightly vegetated at the perimeter beyond the existing workshop with short-lying grasses. Generally the surface comprises either brick paving or gravel wearing course.

The general layout of the Commercial Area is shown in Figure 2 Site Plan below.

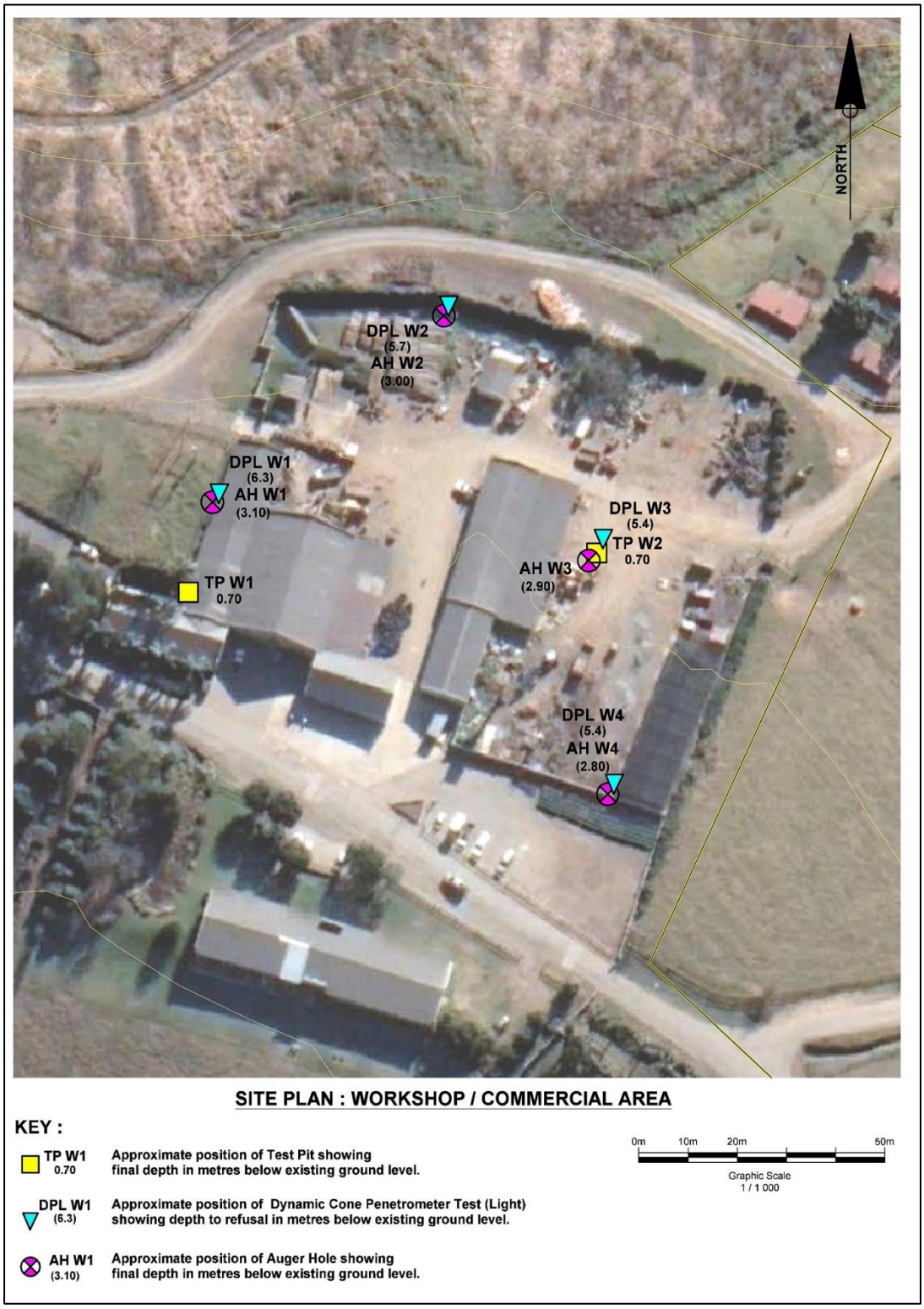


Figure 2: Site Plan showing test pit and DPL test positions in the Workshop / Commercial Area

The following plates provide a more detailed perspective of the site.

Plates 11 & 12: View of the existing offices and workshop site from the east of Voigts Crescent

Plates 13 & 14: View further east along Voigts Crescent of the existing workshop site

Plates 15 & 16: View from the east of the workshop site

4. FIELDWORK

The fieldwork for the investigation was carried out on the 22nd April and comprised the following:

- Mechanically Excavated Test Pits,
- Hand Augered Boreholes,
- Dynamic Cone Penetrometer Light (or DPL) tests, and
- Hand excavated Test Pits to expose existing foundations

4.1 Mechanically Excavated Test Pits

Eight test pits, designated TP1 through TP8, were dug by a TLB excavator supplied by the Client at the Forest Village area to maximum depths ranging between 2.00 and 3.00 metres below existing ground level (mbegl) at the approximate positions shown in Figure 1.

Test pits TP1 to TP5 were dug near the existing foundations of the old, demolished farmhouses and TP6 to TP8 were dug along the access road.

While most of the pits reached a maximum depth of 3.00m, TP6 and TP8 however refused on large sandstone boulders at 2.50 and 2.00 mbegl, respectively.

Two test pits, designated TP-W1 and TP-W2, were dug by hand to maximum depths of 0.70 mbegl at the approximate positions shown in Figure 2.

All test pits were logged[1] and sampled by an Engineering Geologist. The detailed copies of the soil profiles are provided in Appendix A.

4.2 Hand Augered Boreholes

Four hand augered boreholes, designated AH-W1 to AH-W4, were drilled by hand operated auger to evaluate the ground conditions at the approximate position shown on Figure 2 at the existing workshop area. The boreholes were advanced to final depths ranging between 2.80 and 3.10 mbegl.

The spoil recovered from the boreholes was logged. The detailed copies of the soil profiles are provided in Appendix B.

4.3 Dynamic Cone Penetrometer (Light) Tests

Eight Dynamic Cone Penetrometer (Light), or (DPL), tests, designated DPL1 through DPL8, were carried out at the approximate positions at the Forest Village as shown in Figure 1 to determine the consistency of the soils underlying the site and possible depth to bedrock.

Four DPL tests designated DPL W1 to DPL W4 were carried out at the approximate positions at the proposed Commercial Area as shown in Figure 2.

The DPL test comprises a 25mm diameter solid steel retractable cone driven vertically into the ground using a 10 kg hammer dropped through a height of 550mm. The resistance to penetration is measured in terms of number of blow counts per 300mm advance. The DPL test can refuse on boulders, cemented layers as well as bedrock. Due to the nature of the test no soil samples are recovered from the DPL equipment.

The results of the DPL tests, consisting of plots of blow count and inferred soil strength parameters against depth, are given in Appendix C.

4.4 Inspection of Existing Foundations

Proposed Forest Village

The foundations for the demolished superstructures of old farmhouses were inspected in the Forest Village area by means of hand dug test pits.

Table 1
Foundation Depths

House	Footing Depth below existing ground level (mm)	Inferred Footing Width / thickness(mm)
1	280	600 / 160
2	270	<600 / 150
3	330	600 / 200
4	300	<600 / 130
5	250	600 / 200
6	330	<600 / 200
7	300	600 / 150
8	400	<600 / 160

Plates 17 to 19: Foundations of partially demolished Farm Houses - Forest Village area

Proposed Commercial Area

The foundations beneath the existing buildings at the office / workshop area were checked in two places. Generally, these foundations were found to comprise 750mm wide strip footings founded at a depth of 0.70 mbegl.

Plates 20 & 21: TP W1 & TP W2 showing the foundations measured at the existing workshop area

5. SITE GEOLOGY

5.1 General Geology

The general geology of the area according to the geological map 1:250 000 series Durban 2930 published by the Council for Geosciences shows the site to be underlain by the rocks of the Volksrust Formation of the Ecca group with localised, intrusive Dolerite forming as dykes or sills in the region.

The actual geology on the site was confirmed by the results of the fieldwork carried out and comprised a completely weathered dolerite sill, occurring from ground surface as a clayey silty sand. This sill overlies completely weathered sandstone of the Volksrust Formation beneath some parts of the site.

No bedrock was encountered in this geotechnical investigation.

5.2 Forest Village

The Forest Village site is generally underlain by a mantle of soil comprising a surficial layer of colluvium which overlies a relatively thick mantle of either residual dolerite soils or residual sandstone soil or both.

The colluvium, occurring from ground surface generally comprises dry to moist dark brown, loose to medium dense, silty clayey fine-grained sand, and occurs to a depth of about 0.35 to 0.90 mbegl.

Underlying the colluvial soils residual dolerite soils comprising reddish brown clay which generally grades into an orangey brown gravelly cobbley sandy clay with depth. The residual dolerite soils were identified in each test pit dug drilled at the locations shown in Figure 1.

Boulders were encountered in some of the test pits put down at the Forest Village. These boulders are described as medium to large sized, dark grey stained brown subrounded medium hard to hard rock dolerite and sandstone.

From the results of the DPL tests put down the upper colluvial soils generally exhibit a consistency of loose to medium dense to between 0.30 and 0.90 mbegl. Below this depth the residual soils are generally medium dense and/or firm, but which improves to dense and /or stiff below about 3m depth.

Plates 22 to 28 show the soil profiles at the Forest Village area.

Plates 22 & 23: Colluvium overlying residual dolerite soils comprising sandy clays with occasional dolerite and sandstone boulders

Plates 24 & 25: Residual Dolerite soils overlying residual sandstone comprising clayey sands

Plates 26 to 28: TP7 and TP8 excavated along the access road for the Forest Village. These test pits show abundant sandstone boulders in a matrix of clayey sand

5.3 Proposed Commercial (Workshop) Area

The proposed Commercial area located at the existing workshop site is underlain by a relatively thick mantle of residual dolerite soils which overly residual sandstone soils.

The residual dolerite soil, occurring from ground surface generally comprises moist dark reddish-brown clay, soft becoming firm with depth, and occurs to a depth of about 2.80 to 3.00 mbegl or more.

Residual sandstone soils were encountered beneath the residual dolerite soils and comprise a light brown to yellowish brown medium grained sand. The residual sandstone soils were encountered in three of the four augered holes before encountering refusal depth.

From the results of the DPL tests put down the upper colluvial soils generally exhibit a consistency of very soft to soft to an average depth of 0.90 mbegl. Below this depth the residual soils generally improve in consistency to firm to about 2.10m and improve very gradually to dense or stiff near refusal depth.

Plates 29 & 30: Spoils retrieved from AH1 (left) and AH2 (right) showing a thin layer of colluvium (dark brown sandy clays) overlying residual dolerite soils (reddish clays) which further overly residual sandstone soils (light brown sands)

6. GROUNDWATER

No groundwater was observed in the test pits, or the hand augered boreholes, put down on site.

It can generally be expected, however, that groundwater seepage will occur at the interface between the transported soils and the residual soils/and or bedrock, particularly during or after periods of heavy rainfall.

7. LABORATORY TESTING AND MATERIALS ASSESSMENT

7.1 Laboratory Test Results

Laboratory testing was scheduled on selected samples that were obtained from selected layers in the test pits. The following tests were conducted:

- Foundation indicator tests (Particle Size Distribution, Atterberg Limits and hydrometer analysis), and
- Materials Strength tests incorporating Modified AASHTO and California Bearing Ratio tests.

The laboratory test results are summarised in Table 2 below and the full results are contained in Appendix D.

Table 2
Summary of Results of Particle Size Distribution Analysis, Atterberg Limit Determinations and CBR tests

TP No.	Depth (m)	Description	Particle Size %				Atterberg Limits			GM	Modified AASHTO		CBR Values (%) Compaction MDD (%)					Swell (%)	Classification & Activity
			Clay	Silt	Sand	Gravel	LL	PI	LS %		MDD (kg/m³)	OMC %	90	93	95	98	100		
TP2	0.00-0.60	Moist dark reddish brown loose intact silty clayey fine grained SAND. Colluvium.	13.2	14.4	71.7	0.7	-	SP	0.5	0.75	1428	29.2	4.1	5.4	7.0	12	17	0.53	A-2-4(0); SC; Low; G10
	0.60-3.00	Moist reddish brown firm to stiff with depth with zones of soft intact slightly sandy CLAY. Residual Dolerite.	38.0	13.1	44.3	4.7	44	19	9.5	0.87	1803	14.6	1.6	2.5	3.2	4.4	5.4	1.2	A-7-6(8); CL; Low; Less than G10
TP6	0.00-1.50	Moist reddish brown soft becoming firm intact silty sandy CLAY. Residual Dolerite.	52.7	16.0	28.4	3.0	36	13	6.5	0.24									A-6(9); CL; Low;
TP7	0.40-3.00	Moist light brown medium dense intact slightly clayey SAND. Residual Sandstone.	16.6	14.9	68.2	0.2	-	SP	0.5	0.66	1520	27.0	1.7	2.5	3.3	6.3	10	0.4	A-4(0); SC; Low; Less than G10

LL - Liquid Limit
PI - Plasticity Index
LS - Linear Shrinkage
GM - Grading Modulus
MDD - Maximum Dry Density
OMC - Optimum Moisture Content

Classification in Terms of:
USPRA[1]
Unified Soil Classification System[2]
D.H. Van Der Merwe (1964)[3]
TRH14:1985[4]

[1] US Public Roads Administration Classification (Modified from Allen 1945)
[2] ASTM D 2487-06 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). June 2006
[3] D.H. Van Der Merwe (1964). The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp 103-107
[4] TRH14:1985. Guidelines for Road Construction Materials: Technical Recommendations for Highway. Department of Transport SA

8. GENERAL STABILITY OF THE SITE

No signs of general ground instability, such as tension cracks, slope deformations, or surface emission of groundwater were noted during the site investigation.

Provided the recommendations in this report are adhered to, no slope stability problems are anticipated for the proposed development.

9. DEVELOPMENT RECOMMENDATIONS

9.1 Proposed Development

The geotechnical investigation carried out for the Mount Verde Development concentrated three main components:

- Housing units to be constructed where the existing demolished houses are located.
- Conversion of workshop into a commercial / retail area, and
- Access road serving the development

9.2 Excavation Requirements

An indication of the depth to which Soft Excavation[5], can be carried out is obtained from the final depths of the test pits, DPL tests, and hand augered boreholes. These depths are shown in Figure 1 and Figure 2. In general, Soft Excavation to an average depth of about 3.00 mbegl is feasible beneath most of the site.

All test pits were stable during the investigation, and it is considered that excavations with vertical sidewalls of maximum 1.50m depth will be stable over the short term. Deeper excavations should be created with a batter slope not steeper than 1V:1.5H, or otherwise supported. Rainfall or groundwater seepage will result in potential instability and daily checks by experienced personnel will be required to ensure the safety of workers and plant in the excavations.

Occasional sandstone and dolerite boulders can be expected to occur erratically beneath the site. These may range in size from small to large and may result in over-excavation of trenches and platforms where they occur. Very large boulders may be difficult to excavate and may require pre-splitting to facilitate removal.

9.3 Materials Classification and Usage

The soil stratigraphy beneath the site generally comprises a 3-layer sequence where it occurs naturally or is undisturbed:

- Near surface colluvial soils to between 0.3 and 0.9m thick, underlain by
- Residual dolerite soils between 0.5 and 3.0m thick, underlain in places by
- Residual Sandstone

Colluvial Soils

The colluvial soils tested comprise clayey silty sands which have a Plasticity Index of SP (i.e. slightly plastic), silt and clay content of 27%, sand (72%) and a Grading Modulus (GM) of 0.75. The material classifies as A-2-4(0) and SC.

Materials strength tests indicate that the colluvial soils are generally G10 in quality. These materials will be suitable for use as a general road and platform fill but are not recommended for use as a structural fill for founding buildings unless engineered specially for this purpose. They will be moisture sensitive and difficult to compact when they fall outside ± 2% of OMC.

Some variability in this material should be expected across the site.

[5] SANS634:2012: Geotechnical Investigations for Townships: pp16, Table 5 - Classification of material for machine excavation

Residual Dolerite Soils

The residual dolerite soils tested yielded a PI of between 13 and 19, silt and clay content of between 52 and 79% and GM of 0.24 to 0.87. The material classifies in the range A-6(9) and A-7-6(8); and CL. Materials strength test indicate that they are less than G10 in quality. They will be moisture sensitive and difficult to compact when they fall outside ± 2% of OMC.

They are thus considered a very poor subgrade material and will require undercutting where encountered at or near the top of subgrade level.

Residual Sandstone Soils

The residual sandstone soils tested yielded a PI of SP, silt and clay content of 31%, sand (68%) and GM of 0.66. The material classified as A-4(0) and SC. Materials strength tests indicate that they are generally less G10 in quality (CBR <3 @ 90%MDD), however, this material is likely to be on average G10 given its generally sandy composition.

These materials will be suitable for use as a general road and platform fill but are not recommended for use as a structural fill for founding buildings unless engineered specially for this purpose. They will be moisture sensitive and difficult to compact when they fall outside ± 2% of OMC.

Some variability in this material should be expected across the site. In that these soils occur relatively deeply beneath the site, they are not likely to be accessible for use.

9.4 General Earthworks

It is recommended that all earthworks be carried out in accordance with SABS1200DM.

All vegetation should be cleared from the areas over which fills are to be built. In addition, the upper 200mm of topsoil noticeable organic content should be removed and stockpiled for later topsoiling of fill banks or general landscaping purposes.

All fills should be placed in layers not exceeding 200mm loose thickness and compacted to a minimum 93% Modified AASHTO maximum dry density. It is expected that compaction of the clayey soils is best carried out using sheep's foot or stud rollers. Smooth drum rollers will result in biscuit layering typical of delaminating clayey fill materials. All large gravel or boulder inclusions larger than $^{2}/_{3}$ of the fill layer should be removed to spoil.

Where fills are to be built on slopes with slopes steeper than 1V:6H they should be benched in layers into the insitu material. Benches should have maximum height 300mm and width not less than 3m.

Materials used for fill will be derived from the cut area of the site and will most likely comprise a mixture of transported and residual soils with weathered dolerite gravel and boulders. These soils are predominantly clayey in nature and generally less than G10 in quality. They have high CBR swells and will therefore be sensitive to moisture content. These materials will heave during compaction if moisture contents are above Optimum Moisture Content, or OMC. It will be necessary to allow the soils when above OMC to dry out before attempting to recompact them. Alternatively, they can be "stabilised" by blending with more granular materials imported to site.

Should the exposed subgrade become wet or saturated by rain at any stage during excavation then the site could be expected to become completely impassable to construction vehicles. This could delay construction considerably until the subgrade dries out sufficiently. If compaction and/or vehicle accessibility problems persist due to high insitu moisture content of the subgrade then it may be necessary to import a capping layer of say G6 quality, compacted to minimum 93% MDD to create a riding and general construction surface once the final platform levels have been achieved.

All terraces and earthworks in general should be sloped to a gradient of not less than 1 vertical in 50 horizontal to prevent ponding and ingress of water into the subsoils. Surface drainage should be directed away from the crests of fill embankments to prevent over-topping and erosion of fill slopes.

Cut and fill slopes should be top-soiled and planted with grass as soon as possible. This will limit erosion of these slopes and the problems associated with wash-away of fill embankments. Continual maintenance of earth slopes is time consuming and costly to both the developer and the eventual owner of the property.

9.5 Drainage

9.5.1 Surface Drainage

A most important factor in the promotion of a stable site is the control and removal of both surface and ground water from the site. It is important that the design of the stormwater management system allow for the drainage of accumulated surface water from building platforms. Disposal of stormwater should in any case conform to the Local Authority's requirements.

9.5.2 Sub-Surface Drainage

While no groundwater was observed in any of the test pits dug on the site, heavy rains can result in perched groundwater seepage in places, creating the need for subsoil drainage. If groundwater seepage is encountered during construction, these zones will need to be controlled with effective subsoil drains, particularly where water is likely to gain ingress into the structural layers of roads and paved areas. The occurrence of seepage at the base of road or platform cuts may also require similar treatment.

It should be expected that all cuttings will attract groundwater over time and judicious installation of subsoil drainage is strongly recommended to protect water ingress into the structural layers of roads and paving, as well as foundations.

9.6 Foundations

9.6.1 Forest Village

NHBRC Founding Class

The foundation indicator results of the residual materials (Table 2) confirm that they are generally of low expansiveness. However, given the depth of formation of the residual soils (to 3mbegl) and absence of groundwater level, some heave can be expected to occur beneath foundations when moisture content changes occur within the soils in response to seasonal precipitation. The soil profiles recorded in Test Pits TP1 through TP8 dug for the new road and within the Forest Village area, have shown that there is significant boulder development within the residual soils, with the residual dolerite soils limited to between 0.80 and 2.40m in thickness. The presence of such boulders will reduce the heave to some extent.

However, measures to mitigate cracking of the structures due to heave beneath foundations should be considered, with the following in mind:

- Total heave movements beneath the site are expected to be in the range 7,5 to 15mm, using the van der Merwe[6] heave prediction method
- This places the site into the NHBRC foundation class H1.
- Differential heave should be taken as 50% of the above
- Design of foundations to comprise the following:
    - Lightly reinforced strip footings
    - Articulation joints at all internal/external doors and openings
    - Light reinforcement in masonry
    - Site drainage and plumbing/service precautions

Existing Foundations

The existing foundations which have been left in place after the superstructures have been demolished are not considered suitable for re-use, unless the Structural Engineer is able to make these compatible with the design requirements for the H1 foundation class indicated above.

[6] D.H. Van Der Merwe (1964). The Prediction of Heave from the Plasticity Index and Percentage Clay Fraction of Soils. The Civil Engineer, pp 103-107

9.6.2 Commercial (Workshop) Area

The existing foundations in this area appear adequate and no major cracking was evident in the existing buildings.

Foundations for all new buildings should follow the guidelines for NHBRC foundation class designated H1 as discussed above.

It is recommended that all foundation excavations are inspected by GGS to confirm depth of founding and bearing pressure.

9.7 Recommended Good Building Practice

The following good building practice is recommended:

- All buildings should have a concrete surround minimum width 1m with falls to promote drainage away from the structure and thus prevent surface water gaining ingress into the foundation soils
- No sewage or stormwater soakpits should be positioned within 3m of the dwelling
- No plants, i.e. trees or flower beds should be located within 3m of the building
- All platforms should be re-shaped prior to house construction to ensure that drainage of stormwater is promoted so that it will not accumulate at ground surface or cause erosion of the fill edges and platform in general

9.8 Recommended Subgrade Treatment – Roads, Paved and Parking Areas

Provided the new access road is to be constructed on the colluvial soils a nominal subgrade treatment can be adopted, comprising ripping to 300mm and recompacting to 93% MDD, where a CBR of 5 may be used for design.

However, where terracing or platform cuts expose the clayey dolerite subgrade material then undercutting below the top of subgrade level of roads and surface beds and backfilling with a suitable G8/G7 as a selected material is recommended. An undercut depth of 300mm is normally adopted, however, this should be verified by the Engineer.

10. CONCLUSIONS

This report contains the findings of a geotechnical investigation carried out for the Proposed Mount Verde Development in Hilton, KwaZulu-Natal.

The site is underlain by a relatively thin mantle of colluvium overlying relatively deeply developed residual dolerite and, in some areas, residual sandstone soils. While no bedrock was encountered in this investigation, boulders of hard rock dolerite and sandstone, of small to large size, were encountered beneath some parts of the site.

The results of the geotechnical investigation are presented. Recommendations are provided for excavations, general earthworks, foundations, materials usage and road subgrade preparation for the proposed development.

Finally, the information given in this report relates specifically to the positions of the test pits, augered boreholes and DPL tests carried out on this site. Variations in ground conditions may be encountered elsewhere on the site during construction. As a result, GGS should be consulted if ground conditions vary from those given in this report so that timeous solutions may be arrived at.

APPENDIX A

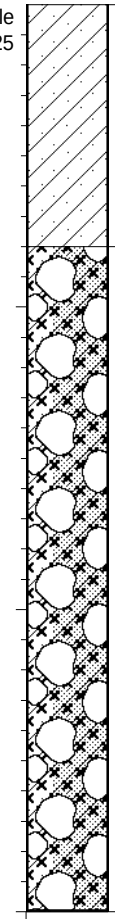
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP1**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark reddish brown soft slightly sandy CLAY. Colluvium.

0.80 Moist reddish brown becoming orangey brown with depth firm to stiff with depth with zones of soft intact slightly sandy CLAY, with occasional subrounded highly weathered soft to medium hard rock dolerite boulders throughout. Residual Dolerite.

3.00

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

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PROFILED BY : SR

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X-COORD :
Y-COORD :

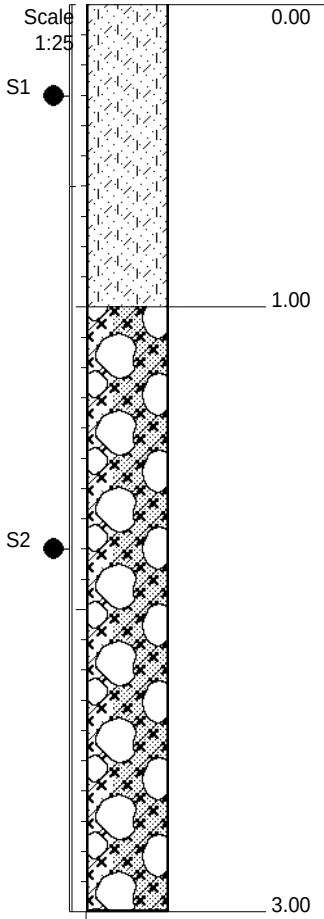
HOLE No: **TP1**

GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP2**
Sheet 1 of 1

JOB NUMBER: 20-037



0.00 Moist dark reddish brown loose intact silty clayey fine grained SAND. Colluvium.

1.00 Moist reddish brown firm to stiff with depth with zones of soft intact slightly sandy CLAY, with occasional subrounded highly weathered soft to medium hard rock dolerite boulders throughout. Residual Dolerite.

3.00

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.00--0.60m (3 x Bulk)
   S2 0.60--3.00m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP2**

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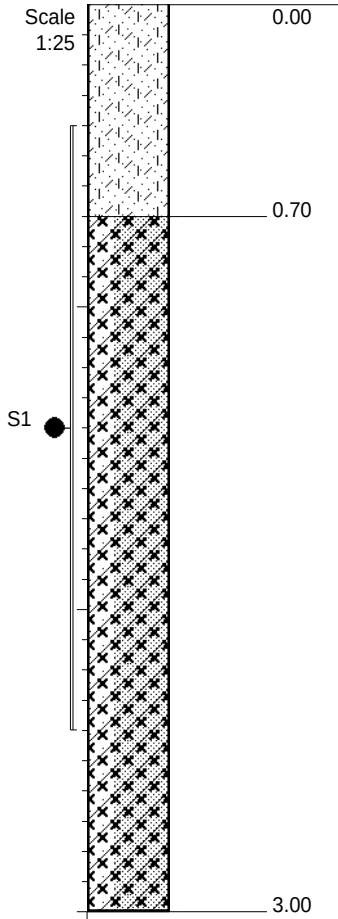
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP3**
Sheet 1 of 1

JOB NUMBER: 20-037



Moist dark reddish brown loose intact silty clayey fine grained SAND. Colluvium.

Moist brown to reddish brown firm becoming stiff with depth slightly sandy CLAY. Residual Dolerite.

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.40--2.40m (2 x Small)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022
DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP3**

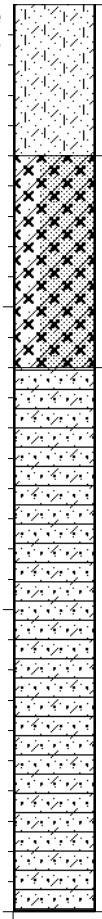
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP4**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00	Moist dark reddish brown loose intact silty clayey fine grained SAND. Colluvium.
0.50	Moist brown to reddish brown firm to stiff intact slightly sandy CLAY. Residual Dolerite.
1.20	Moist orangey brown medium dense intact clayey fine to coarse grained SAND. Residual Sandstone.
3.00	

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP4**

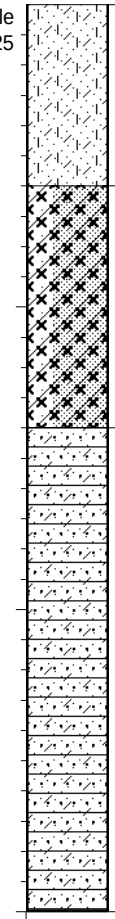
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP5**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark reddish brown loose intact silty clayey fine grained SAND. Colluvium.

0.60 Moist brown to reddish brown firm to stiff intact slightly sandy CLAY. Residual Dolerite.

1.40 Moist orangey brown medium dense intact clayey fine to coarse grained SAND. Residual Sandstone.

3.00

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

ELEVATION :
X-COORD :
Y-COORD :

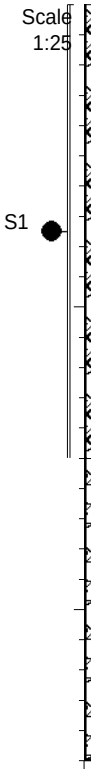
HOLE No: **TP5**

GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP6**
Sheet 1 of 1

JOB NUMBER: 20-037



0.00

Moist reddish brown soft becoming firm intact silty sandy CLAY with occasional small soft to medium hard rock dolerite boulders throughout. Residual Dolerite.

1.50

Brown highly weathered medium hard rock sandstone BOULDERS in a matrix of moist brown to reddish brown sandy clay.

2.50

NOTES

1) Final depth at 2.50m. Refusal on large sandstone boulders.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.00--1.50m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022
DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

ELEVATION :
X-COORD :
Y-COORD :

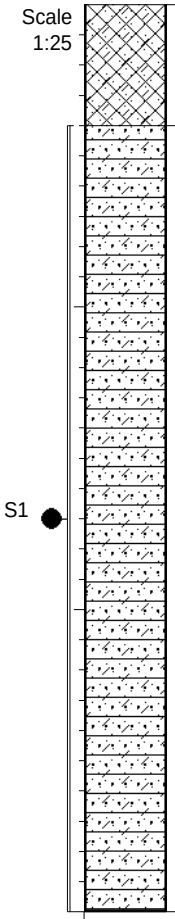
HOLE No: **TP6**

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP7**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark brown loose becoming medium dense intact clayey SAND. Fill.

0.40 Moist light brown medium dense intact slightly clayey SAND. Residual Sandstone.

3.00

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) Samples taken :
   S1 0.40--3.00m (3 x Bulk)

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP7**

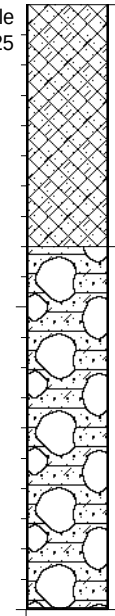
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Forest Village Area

HOLE No: **TP8**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark brown loose becoming medium dense intact clayey SAND. Fill.

0.80 Brown highly weathered medium hard rock sandstone BOULDERS in a matrix of moist brown to reddish brown clayey sand.

2.00

NOTES

1) Final depth at 2.00m. Refusal on large sandstone boulders.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP8**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

DATE : 08/06/2022 12:58
TEXT : ..ntHilton\Logs\TP1TP8.doc

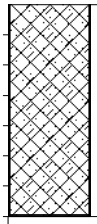
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **TP-W1**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark brown medium dense intact clayey fine grained SAND. Fill.

0.70

NOTES

1) Final depth at 0.70m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.
5) Footing: 0.00-0.55m vertical
   Toe: 0.20m horizontal and 0.20m thick

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 17/06/2022 10:40
TEXT : ..Hilton\Logs\TPW1TPW2.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP-W1**

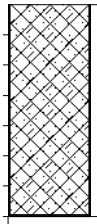
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **TP-W2**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark brown medium dense intact clayey fine grained SAND. Fill.

0.70

NOTES

1) Final depth at 0.70m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.
5) Footing: 0.00-0.50m vertical
   Toe: 0.20m horizontal and 0.21m thick

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 17/06/2022 10:40
TEXT : ..Hilton\Logs\TPW1TPW2.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **TP-W2**

APPENDIX B

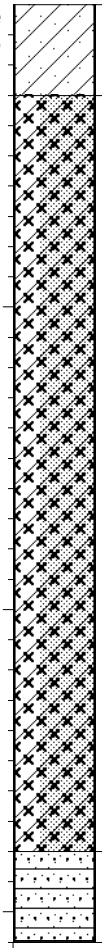
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **AH-W1**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00	Moist brown sandy CLAY. Topsoil.
0.30	Moist dark reddish brown CLAY. Residual Dolerite.
2.80	Dry yellowish brown fine to medium grained SAND. Residual Sandstone.
3.10	

NOTES

1) Final depth at 3.10m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **AH-W1**

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

DATE : 08/06/2022 12:56
TEXT : ..Hilton\Logs\AHW1AHW4.doc

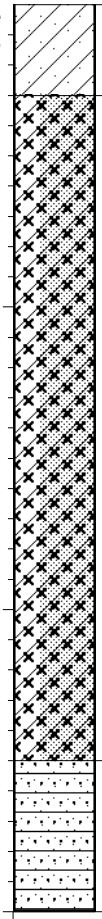
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **AH-W2**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00	Moist brown sandy CLAY. Topsoil.
0.30	Moist dark reddish brown CLAY. Residual Dolerite.
2.50	Dry yellowish brown fine to medium grained SAND. Residual Sandstone.
3.00	

NOTES

1) Final depth at 3.00m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 08/06/2022 12:56
TEXT : ..Hilton\Logs\AHW1AHW4.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **AH-W2**

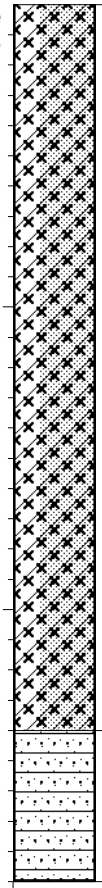
GONDWANA GEO SOLUTIONS

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **AH-W3**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark reddish brown CLAY. Residual Dolerite.

2.40 Dry yellowish brown fine to medium grained SAND. Residual Sandstone.

2.90

NOTES

1) Final depth at 2.90m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR

TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022

DATE : 08/06/2022 12:56
TEXT : ..Hilton\Logs\AHW1AHW4.doc

ELEVATION :
X-COORD :
Y-COORD :

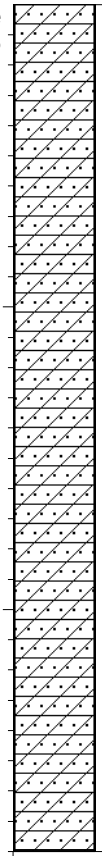
HOLE No: **AH-W3**

UMSUNGULI PROJECT MANAGEMENT
Mount Verde Development, Hilton
Workshop / Commercial Area

HOLE No: **AH-W4**
Sheet 1 of 1

JOB NUMBER: 20-037

Scale 1:25



0.00 Moist dark reddish brown CLAY. Residual Sandstone.

2.80

NOTES

1) Final depth at 2.80m.
2) No groundwater seepage.
3) No sidewall collapse.
4) No samples taken.

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : SR
TYPE SET BY : MC
SETUP FILE : GGS-ST~1.SET

INCLINATION :
DIAM :
DATE : 22/04/2022
DATE : 22/04/2022
DATE : 08/06/2022 12:56
TEXT : ..Hilton\Logs\AHW1AHW4.doc

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: **AH-W4**

APPENDIX C

GONDWANA GEO SOLUTIONS

Consulting Geotechnical Engineers & Engineering Geologists

Cape Town Office:
13 Rocklands Road
Simonstown
CAPE TOWN
7975

Durban Office:
4 Haven Road
Westville
DURBAN
3629

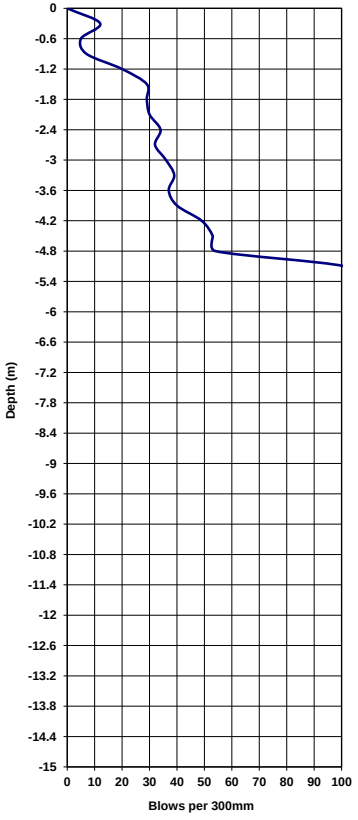
Client:	**UMSUNGULI PROJECT MANAGEMENT**	**Ref.No.**	**22-037**
Project:	**Mount Verde Development**	**Date:**	**26/05/2022**
Section:	**Forest Village**	**Operator:**	**SR**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 1***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Loose
0.6	5	Very Loose
0.9	7	Very Soft
1.2	20	Firm
1.5	29	Firm
1.8	29	Firm
2.1	30	Firm
2.4	34	Stiff
2.7	32	Firm
3	36	Stiff
3.3	39	Stiff
3.6	37	Stiff
3.9	40	Stiff
4.2	49	Stiff
4.5	53	Stiff
4.8	54	Stiff
	Ref	

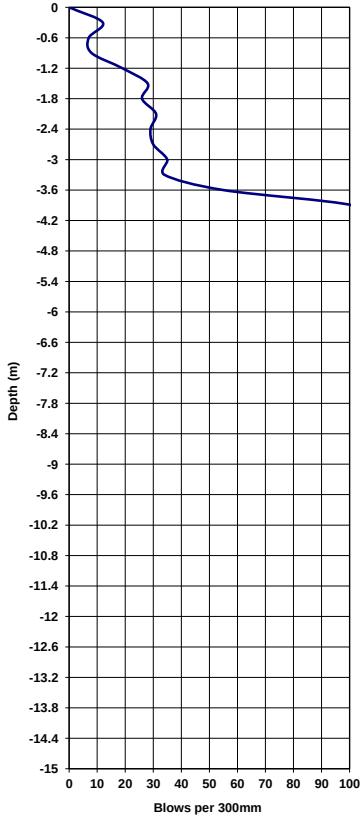


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 2***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Loose
0.6	7	Loose
0.9	8	Loose
1.2	19	Firm
1.5	28	Firm
1.8	26	Firm
2.1	31	Firm
2.4	29	Firm
2.7	30	Firm
3	35	Stiff
3.3	34	Stiff
3.6	55	Stiff
	Ref	

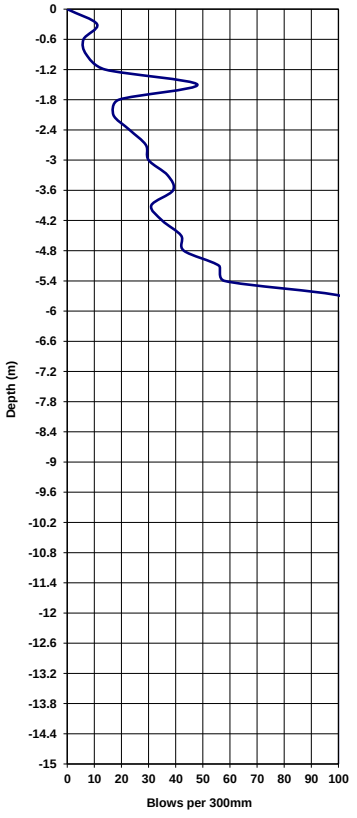


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 3***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	11	Loose
0.6	6	Very Loose
0.9	7	Very Soft
1.2	14	Soft
1.5	48	Stiff
1.8	19	Firm
2.1	17	Firm
2.4	23	Firm
2.7	29	Firm
3	30	Firm
3.3	37	Stiff
3.6	39	Stiff
3.9	31	Firm
4.2	35	Stiff
4.5	42	Stiff
4.8	43	Stiff
5.1	56	Stiff
5.4	58	Stiff
	Ref	



THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

GONDWANA GEO SOLUTIONS

Consulting Geotechnical Engineers & Engineering Geologists

Cape Town Office:
13 Rocklands Road
Simonstown
CAPE TOWN
7975

Durban Office:
4 Haven Road
Westville
DURBAN
3629

Client:	**UMSUNGULI PROJECT MANAGEMENT**	**Ref.No.**	**22-037**
Project:	**Mount Verde Development**	**Date:**	**26/05/2022**
Section:	**Forest Village**	**Operator:**	**SR**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 4***

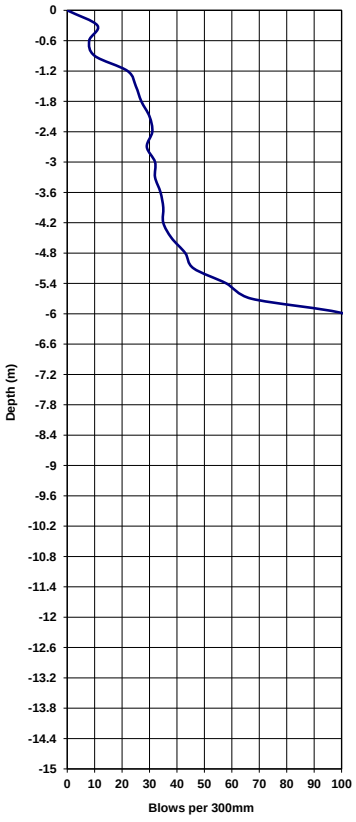
Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 5***

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 6***

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	11	Loose
0.6	8	Loose
0.9	10	Soft
1.2	22	Firm
1.5	25	Med.Dense
1.8	27	Med.Dense
2.1	30	Med.Dense
2.4	31	Med.Dense
2.7	29	Med.Dense
3	32	Med.Dense
3.3	32	Med.Dense
3.6	34	Med.Dense
3.9	35	Med.Dense
4.2	35	Med.Dense
4.5	38	Med.Dense
4.8	43	Dense
5.1	46	Dense
5.4	58	Dense
5.7	67	Dense
	Ref	



C=1
Phi=0

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	14	Loose
0.6	9	Loose
0.9	9	Soft
1.2	21	Firm
1.5	23	Firm
1.8	24	Med.Dense
2.1	29	Med.Dense
2.4	32	Med.Dense
2.7	33	Med.Dense
3	32	Med.Dense
3.3	41	Dense
3.6	37	Med.Dense
3.9	35	Med.Dense
4.2	44	Dense
4.5	46	Dense
4.8	58	Dense
5.1	54	Dense
	Ref	

1
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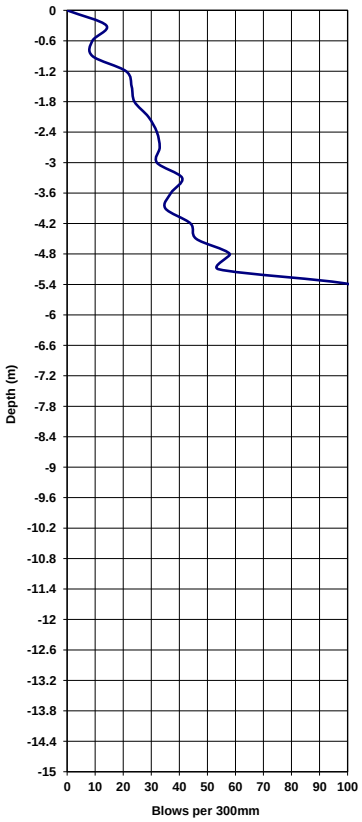
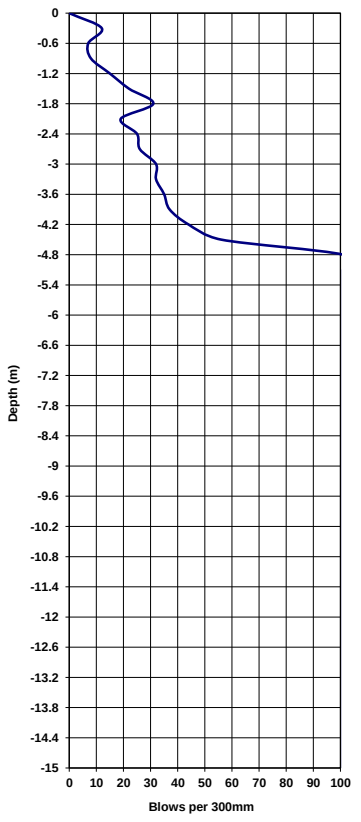


C=1
Phi=0

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	12	Soft
0.6	7	Very Soft
0.9	8	Very Soft
1.2	15	Soft
1.5	22	Firm
1.8	31	Firm
2.1	19	Firm
2.4	25	Firm
2.7	26	Firm
3	32	Firm
3.3	32	Firm
3.6	35	Stiff
3.9	37	Stiff
4.2	44	Stiff
4.5	56	Stiff
	Ref	

1
1
1



C=1
Phi=0

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GONDWANA GEO SOLUTIONS

Consulting Geotechnical Engineers & Engineering Geologists

Cape Town Office:
13 Rocklands Road
Simonstown
CAPE TOWN
7975

Durban Office:
4 Haven Road
Westville
DURBAN
3629

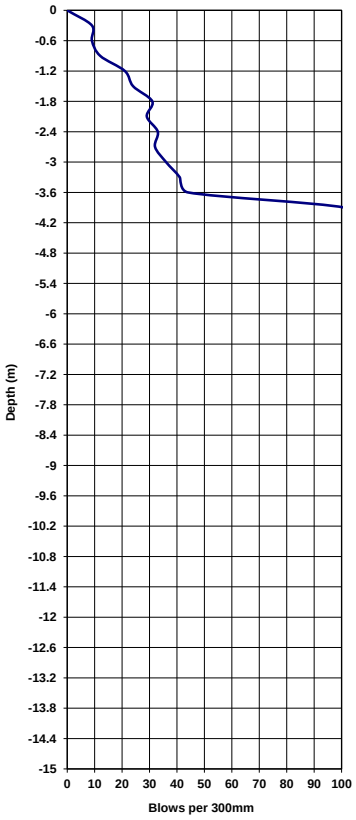
Client:	**UMSUNGULI PROJECT MANAGEMENT**	**Ref.No.**	**22-037**
Project:	**Mount Verde Development**	**Date:**	**26/05/2022**
Section:	**Forest Village**	**Operator:**	**SR**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 7***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	9	Loose
0.6	9	Loose
0.9	12	Loose
1.2	21	Med.Dense
1.5	24	Med.Dense
1.8	31	Med.Dense
2.1	29	Med.Dense
2.4	33	Med.Dense
2.7	32	Med.Dense
3	36	Med.Dense
3.3	41	Dense
3.6	44	Dense
	Ref	

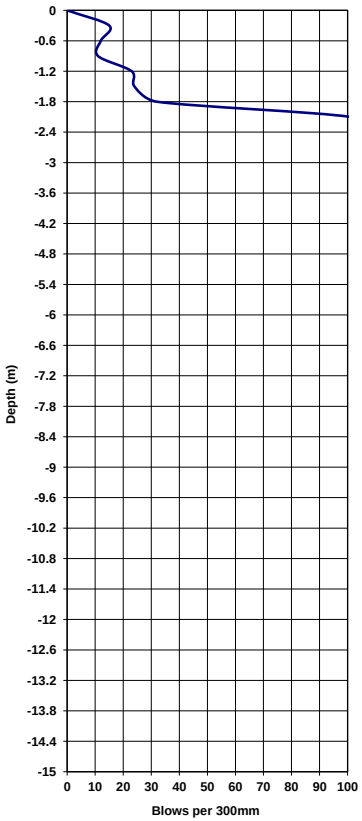


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL 8***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	15	Loose
0.6	12	Loose
0.9	11	Loose
1.2	23	Med.Dense
1.5	24	Med.Dense
1.8	32	Med.Dense
	Ref.	

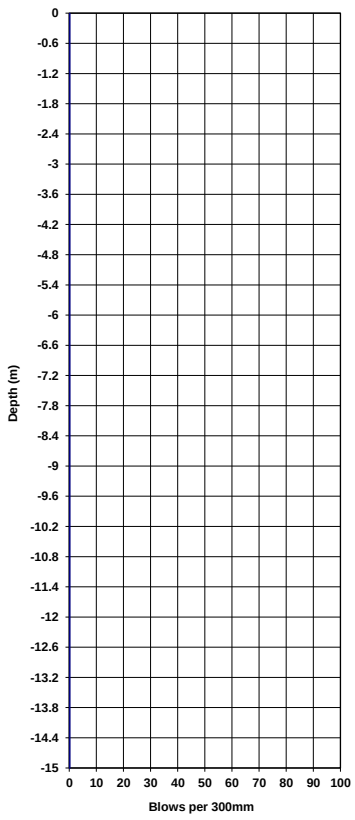


Light Dynamic Penetrometer Probe ----------

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		



THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

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7975

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DURBAN
3629

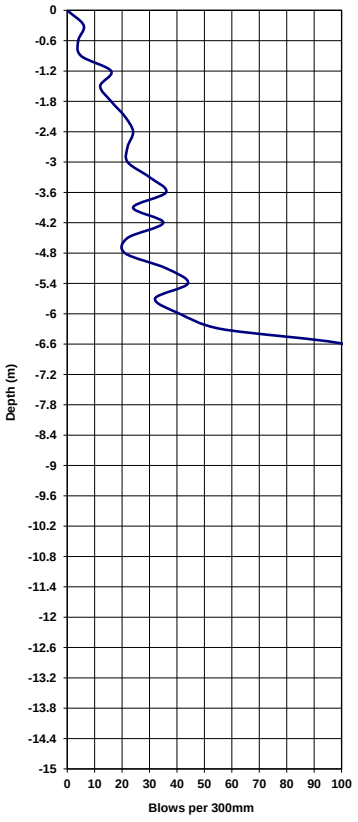
Client:	**UMSUNGULI PROJECT MANAGEMENT**	**Ref.No.**	**22-037**
Project:	**Mount Verde Development**	**Date:**	**26/05/2022**
Section:	**Workshop / Commercial Area**	**Operator:**	**SR**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL W1***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency	
0			
0.3	6	Very Soft	1
0.6	4	Very Soft	1
0.9	5	Very Soft	1
1.2	16	Soft	1
1.5	12	Soft	1
1.8	16	Soft	1
2.1	21	Firm	1
2.4	24	Firm	1
2.7	22	Firm	1
3	22	Med.Dense	
3.3	30	Med.Dense	
3.6	36	Med.Dense	
3.9	24	Med.Dense	
4.2	35	Med.Dense	
4.5	22	Med.Dense	
4.8	21	Med.Dense	
5.1	36	Med.Dense	
5.4	44	Dense	
5.7	32	Med.Dense	
6	41	Dense	
6.3	56	Dense	
	Ref		

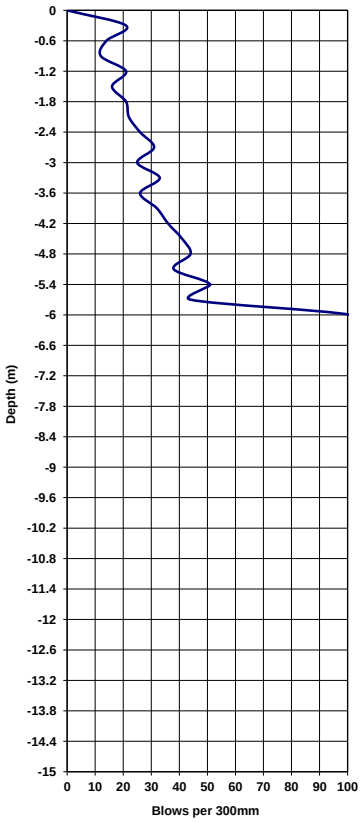


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL W2***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency	
0			
0.3	21	Firm	1
0.6	14	Soft	1
0.9	12	Soft	1
1.2	21	Firm	1
1.5	16	Soft	1
1.8	21	Firm	1
2.1	22	Firm	1
2.4	26	Firm	1
2.7	31	Firm	1
3	25	Med.Dense	
3.3	33	Med.Dense	
3.6	26	Med.Dense	
3.9	32	Med.Dense	
4.2	36	Med.Dense	
4.5	41	Dense	
4.8	44	Dense	
5.1	38	Med.Dense	
5.4	51	Dense	
5.7	44	Dense	
	Ref		

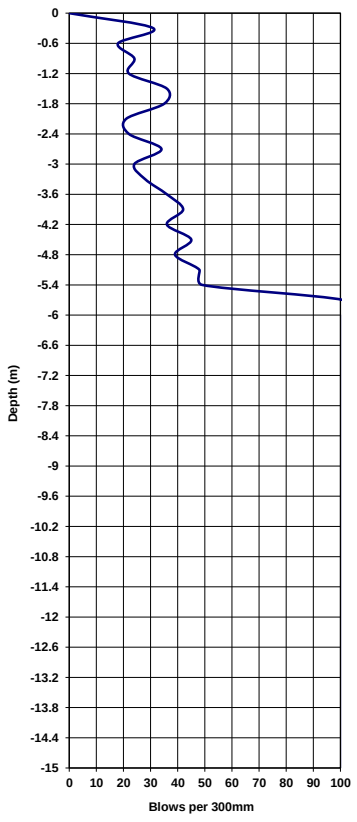


Light Dynamic Penetrometer Probe ---------- ***Test No. DPL W3***

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency	
0			
0.3	31	Firm	1
0.6	18	Firm	1
0.9	24	Firm	1
1.2	22	Firm	1
1.5	36	Stiff	1
1.8	35	Stiff	1
2.1	21	Firm	1
2.4	22	Firm	1
2.7	34	Stiff	1
3	24	Med.Dense	
3.3	28	Med.Dense	
3.6	36	Med.Dense	
3.9	42	Dense	
4.2	36	Med.Dense	
4.5	45	Dense	
4.8	39	Med.Dense	
5.1	48	Dense	
5.4	49	Dense	
	Ref		



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3629

Client:	**UMSUNGULI PROJECT MANAGEMENT**	**Ref.No.**	**22-037**
Project:	**Mount Verde Development**	**Date:**	**26/05/2022**
Section:	**Workshop / Commercial Area**	**Operator:**	**SR**

Light Dynamic Penetrometer Probe ---------- ***Test No. DPL W4***

Light Dynamic Penetrometer Probe ----------

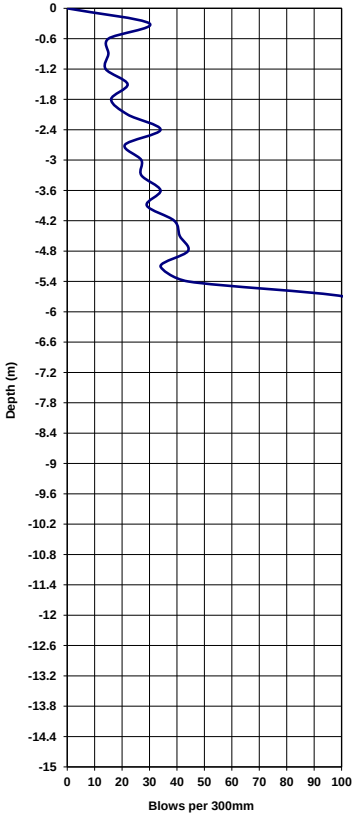
Light Dynamic Penetrometer Probe ----------

THE INSITU STRENGTH DEPENDS ON SOIL MOISTURE CONTENT AND GRAIN STRUCTURE WHICH HAVE NOT BEEN ASSESSED AND MAY CHANGE. THE VALUES GIVEN ARE THEREFORE INDICATIVE ONLY AND SHOULD BE VERIFIED BY TEST OR OBSERVATION

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		
0.3	30	Firm
0.6	15	Soft
0.9	15	Soft
1.2	14	Soft
1.5	22	Firm
1.8	16	Soft
2.1	22	Firm
2.4	34	Stiff
2.7	21	Firm
3	27	Med.Dense
3.3	27	Med.Dense
3.6	34	Med.Dense
3.9	29	Med.Dense
4.2	39	Med.Dense
4.5	41	Dense
4.8	44	Dense
5.1	34	Med.Dense
5.4	44	Dense
	Ref	



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

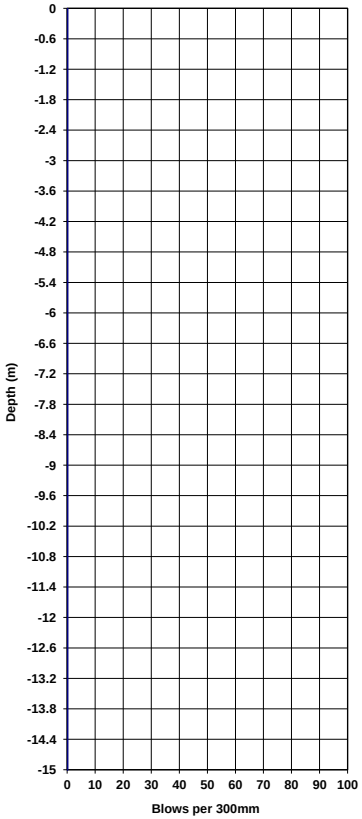
Depth metres	Blows per 300mm	Inferred Consistency
0		

1
1
1
1
1
1
1
1

Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

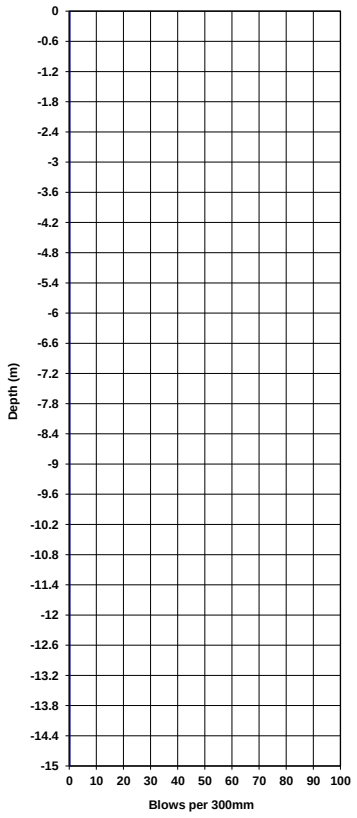
Depth metres	Blows per 300mm	Inferred Consistency
0		



Hammer: 10kg falling 550mm
Cone: 25mm diameter with 60 degree apex angle
Rods: 16mm diameter, 22mm diameter couplings

C=1
Phi=0

Depth metres	Blows per 300mm	Inferred Consistency
0		



APPENDIX D

SGS MATROLAB

sanas Testing Laboratory T 0239

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/029180/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T 0239

60 Columbine Place, Glen Anil, Durban North, 4051

Tel. : (031) 579 1220/1
Fax : (031) 579 1344
Email : rasalis.bhikam@sgs.com

CLIENT :	Gondwana Geo Solutions (Pty) Ltd	OUR REF.:	38283
ADDRESS :	17 Kingmead Drive Westville, Durban 3629	YOUR REF.:	22-031/1
ATTENTION :	Mr Mark Richter	DATE :	16.05.2022

PROJECT : Mt Verde

SGS MATROLAB

a SANAS Accredited Testing Laboratory, No. T 0239

Tests marked * "Not SANAS Accredited" in this Report are not included in the SANAS Schedule of Accreditation for the laboratory.

TEST REPORT / RESULTS

Sample/s:

Sampled by : -
Date Received / Sampled : 03.05.2022
Date Tested : 06.05.2022

Sampling method : -

Section / Position tested identified by : Customer

Number of pages in this Report : 9

General :

Opinions and interpretations expressed herein are outside the Scope of SANAS Accreditation.
Results only have bearing on the samples tested.
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- CIVIL ENGINEERING SERVICES -
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Email : rasalis.bhikam@sgs.com

sanas Testing Laboratory T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd 17 Kingmead Drive Westville, Durban 3629 Attention: Mr Mark Richter	Project : Mt Verde Your Ref : 22-031/1 Our Ref : 38283 Date Reported : 16.05.2022

SIEVE ANALYSIS, ATTERBERG LIMITS, CBR(SANS 3001:GR1,GR10,GR12,GR20,GR30,GR40)

SAMPLE NO.	16079	16080	16082		Preparation Method:
HOLE NO.	TP 2	TP 2	TP 7		Sample was scalped on the 37.5mm sieve
ROAD NO.	-	-	-		
DEPTH	0.0 - 0.60m	0.60 - 3.00m	0.40 - 3.00m		
CHAINAGE	TP 2	TP 2	TP 7		
LAYER TYPE	-	-	-		
STABILISED WITH	Natural	Natural	Natural		
SUPPLIER	-	-	-		
CURING METHOD	-	-	-		
DATE TESTED	06.05.2022	06.05.2022	06.05.2022		
DESCRIPTION	Dark Brown Clayey Sand	Dk Orangey Br to Red Brown Sandy Clay	Light Brown Clay		Specification Min : Max
SIEVE ANALYSIS (% PASSING)					
100 mm					
75 mm					
63 mm					
50 mm					
37.5 mm					
28.0 mm					
20.0 mm					
14.0 mm		100			
5.0 mm	100	99	100		
2.0 mm	99	95	100		
0.425 mm	95	61	98		
0.075 mm	31	57	36		
SOIL MORTAR					
COARSE SAND <2.0mm >0.425mm	4	36	2		
FINE SAND <0.425mm >0.075mm	64	4	62		
MATERIAL <0.075mm	32	60	36		
CONSTANTS					
GRADING MODULUS	0,74	0,87	0,66		
PRA CLASSIFICATION	A-2-4(0)	A-7-6(8)	A-4(0)		
COLTO CLASSIFICATION	---	---	---		
TRH Class.(INSITU |93%|90%|)	G10|G10	- | -	- | -		
LIQUID LIMIT (%)	-	44	-		
PLASTICITY INDEX (0.425mm)	SP	19	SP		
LINEAR SHRINKAGE (%)	1,0	9,5	1,0		
MDD					
MAXIMUM DRY DENSITY (kg/m^3)	1428	1803	1520		
OPTIMUM MOISTURE CONTENT(%)	29,2	14,6	27,0		
MOULDING MOISTURE (%)	29,5	14,9	26,7		
TYPE OF TEST	CBR	CBR	CBR		
CBR-UCS @ 100% MDD	17	5,4	10		
CBR-UCS @ 98% MDD	12	4,4	6,3		
CBR-UCS @ 97% MDD	10	4,0	5,0		
CBR-UCS @ 95% MDD	7,0	3,2	3,3		
CBR-UCS @ 93% MDD	5,4	2,5	2,5		
CBR-UCS @ 90% MDD	4,1	1,6	1,7		

CBR-UCS @ % MDD derived from calculation.

% SWELL MOULD [A][B][C]															
	0,40	0,50	0,70	1,10	1,20	1,30	0,40	0,40	0,40						

Remarks :

FORM: GR40

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/029180/07 - VAT. Reg.No.: 4040210587
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T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd 17 Kingmead Drive Westville, Durban 3629 Attention: Mr Mark Richter	Project : Mt Verde Your Ref : 22-031/1 Our Ref : 38283 Date Reported : 16.05.2022

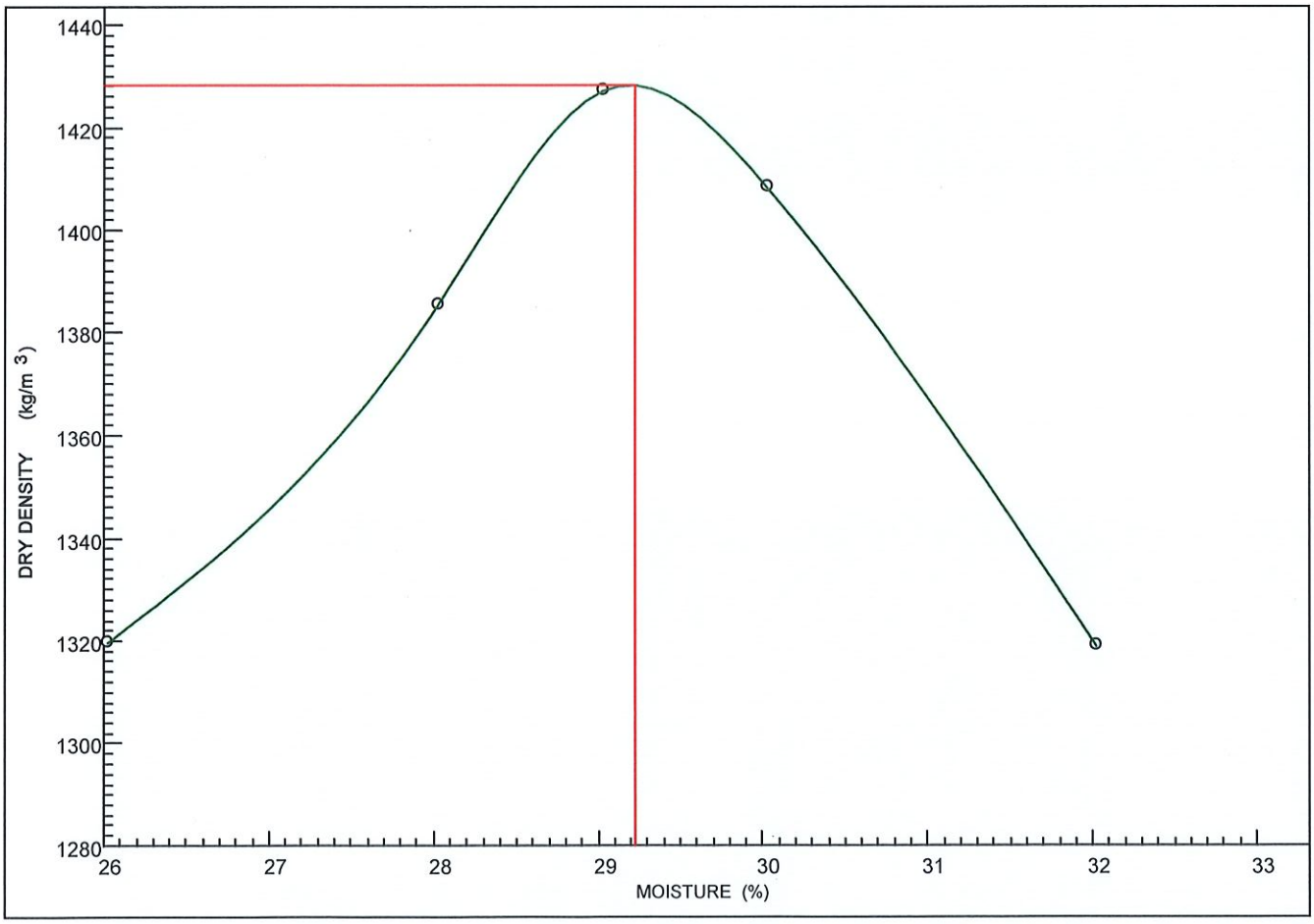
MOISTURE / DENSITY RELATIONSHIP(SANS 3001: GR30)

Sample No.: 16079	Hole No. : TP 2	Depth (mm) : 0.0 - 0.60m
Origin : TP 2	Stabilized With : Natural	Compaction Energy : MDD
Material Description : Dark Brown Clayey Sand		

Maximum Dry Density (kg/m^3): 1428

Optimum Moisture Content (%) : 29,2

Point No.	1	2	3	4	5			
Moisture (%)	26,0	28,0	29,0	30,0	32,0			
Density (kg/m^3)	1320	1385	1427	1408	1319			



Remarks :

FORM: GR30

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

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T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd 17 Kingmead Drive Westville, Durban 3629 Attention: Mr Mark Richter	Project : Mt Verde Your Ref : 22-031/1 Our Ref : 38283 Date Reported : 16.05.2022

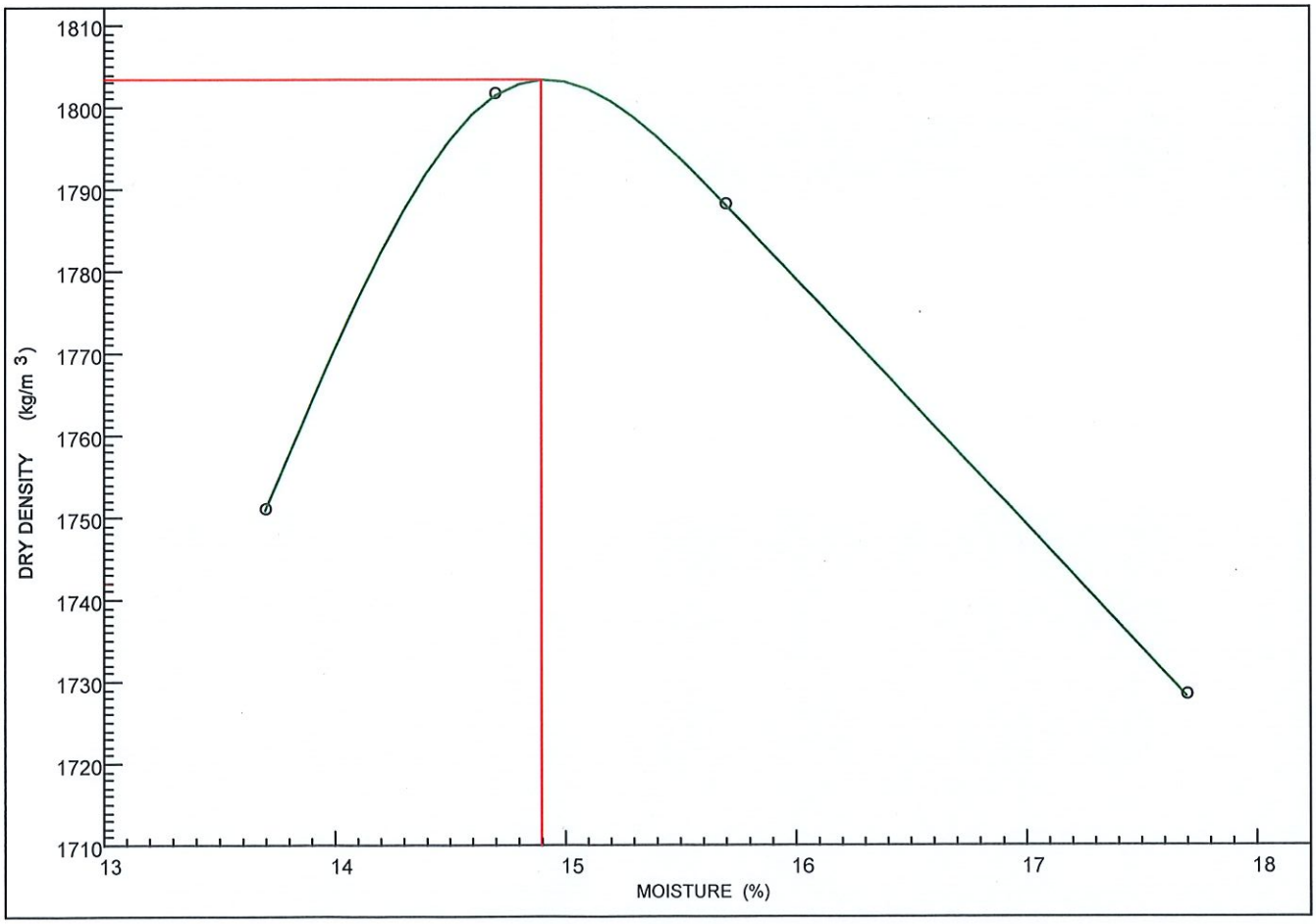
MOISTURE / DENSITY RELATIONSHIP(SANS 3001: GR30)

Sample No.: 16080	Hole No. : TP 2	Depth (mm) : 0.60 - 3.00m
Origin : TP 2	Stabilized With : Natural	Compaction Energy : MDD
Material Description : Dark Orangey Brown to Reddish Brown Sandy Clay		

Maximum Dry Density (kg/m^3): 1803

Optimum Moisture Content (%) : 14,9

Point No.	1	2	3	4				
Moisture (%)	13,7	14,7	15,7	17,7				
Density (kg/m^3)	1751	1801	1788	1728				



Remarks :

FORM: GR30

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

MATROLAB IS NOW PART OF SGS, THE WORLDS`S LEADING INSPECTION, VERFICATION, TESTING AND CERTIFICATION COMPANY.

SGS MATROLAB (PTY) LTD
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sanas Testing Laboratory T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd 17 Kingmead Drive Westville, Durban 3629 Attention: Mr Mark Richter	Project : Mt Verde Your Ref : 22-031/1 Our Ref : 38283 Date Reported : 16.05.2022

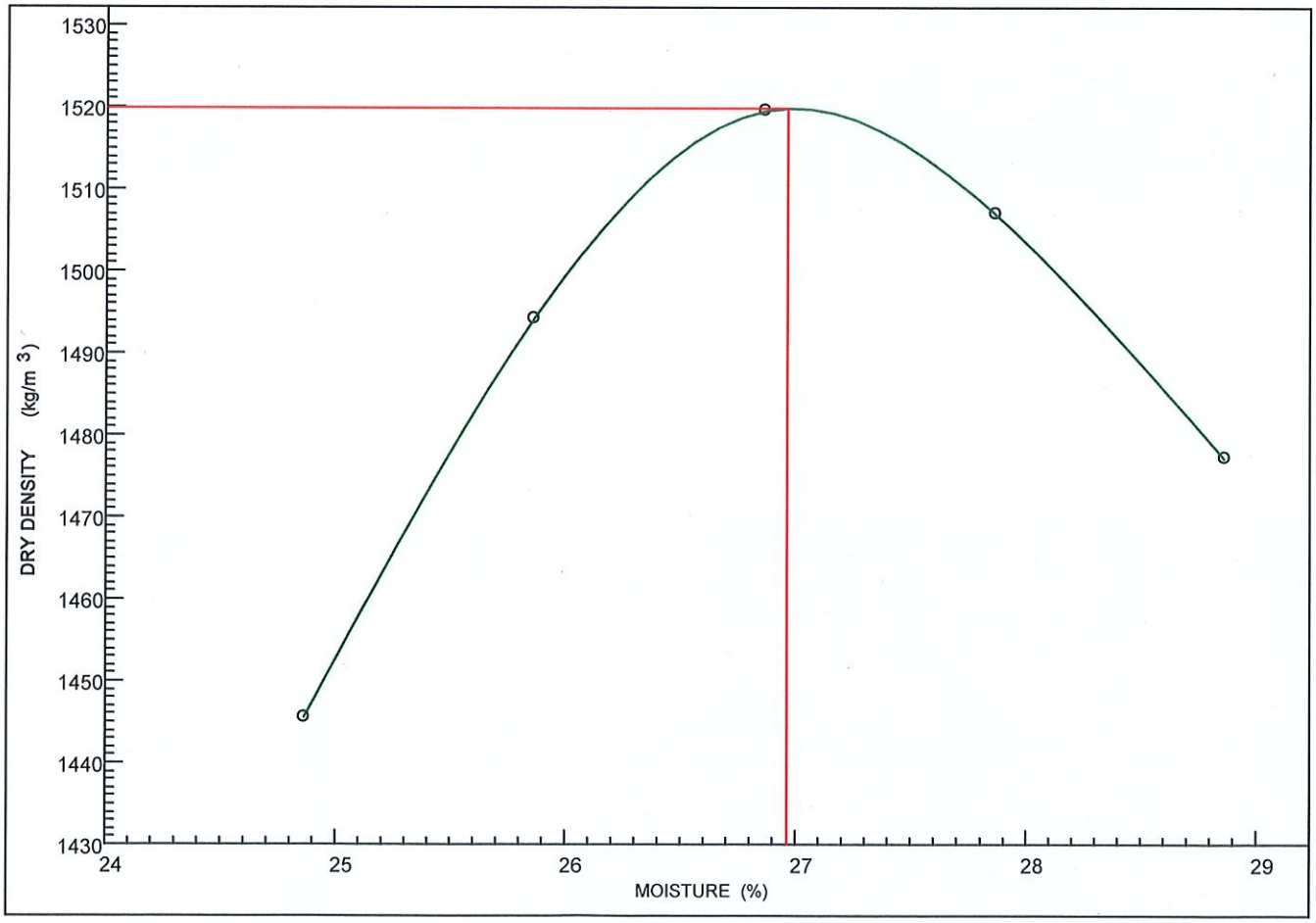
MOISTURE / DENSITY RELATIONSHIP(SANS 3001: GR30)

Sample No.: 16082	Hole No. : TP 7	Depth (mm) : 0.40 - 3.00m
Origin : TP 7	Stabilized With : Natural	Compaction Energy : MDD
Material Description : Light Brown Clay		

Maximum Dry Density (kg/m^3): 1520

Optimum Moisture Content (%) : 27,0

Point No.	1	2	3	4	5			
Moisture (%)	24,9	25,9	26,9	27,9	28,9			
Density (kg/m^3)	1446	1494	1520	1507	1477			



Remarks :

FORM: GR30

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

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T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd
17 Kingmead Drive
Westville, Durban
3629
Attention: Mr Mark Richter

Project : Mt Verde

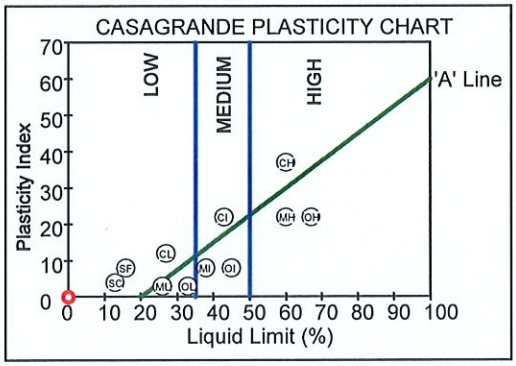
Your Ref : 22-031/1
Our Ref : 38283
Date Reported : 16.05.2022

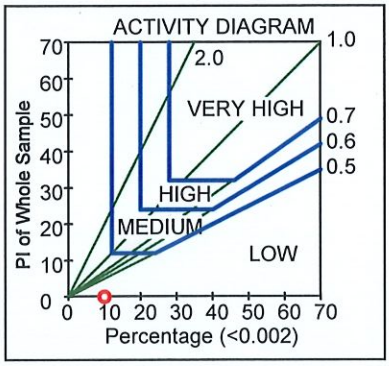
FOUNDATION INDICATOR (ASTM: D422)

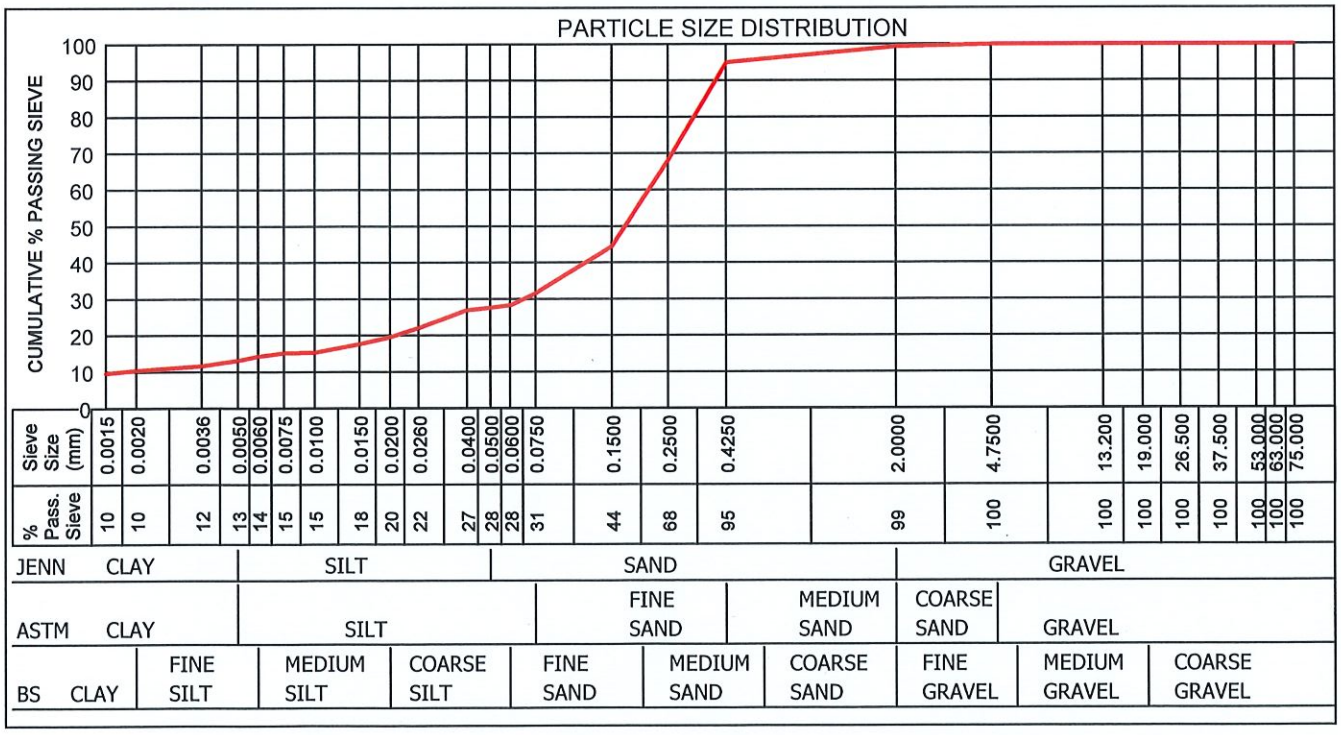
Sample No.	: 16079
Hole No.	: TP 2
Depth	: 0.0 - 0.60m
Liquid Limit (%)	: -
Plasticity Index	: SP
Linear Shrinkage (%)	: 0,5
PI of Whole Sample	: 0
P.R.A. Classification	: A-2-4(0)
Unified Soil Classificati	: SC
Activity	: 0,00
Heave Classification	: LOW
Grading Modulus	: 0,75
Percentage (<0.002)	: 10,0
Moisture Content (%)	: 33,0

Material Description : Dark Brown SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	13,2	14,4	71,7	0,7	SILTY SAND
Astm	13,2	18,3	68,6	0,0	SILTY SAND
British Standard	10,4	17,9	71,0	0,7	SILTY SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	10	10	12	13	14	15	15	18	20	22	27	28	28	31	44	68	95	99	100	100	100	100	100	100	100	100

JENN	CLAY		SILT		SAND			GRAVEL		
ASTM	CLAY		SILT			FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL	
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks :

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

SGS MATROLAB (PTY) LTD
- CIVIL ENGINEERING SERVICES -
Reg.No.: 2003/029180/07 - VAT. Reg.No.: 4040210587
a SANAS Accredited Testing Laboratory, No. T 0239

60 Columbine Place, Glen Anil, Durban North, 4051

Tel. : (031) 579 1220/1
Fax : (031) 579 1344
Email : rasalis.bhikam@sgs.com

sanas Testing Laboratory T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd
17 Kingmead Drive
Westville, Durban
3629
Attention: Mr Mark Richter

Project : Mt Verde

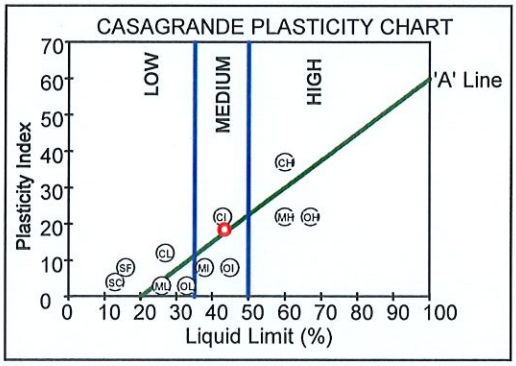
Your Ref : 22-031/1
Our Ref : 38283
Date Reported : 16.05.2022

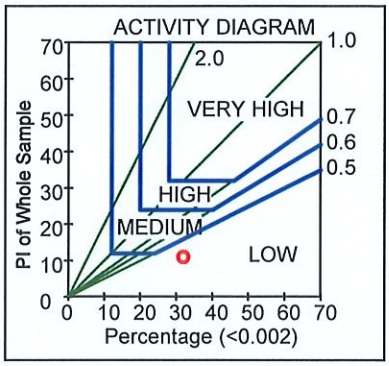
FOUNDATION INDICATOR (ASTM: D422)

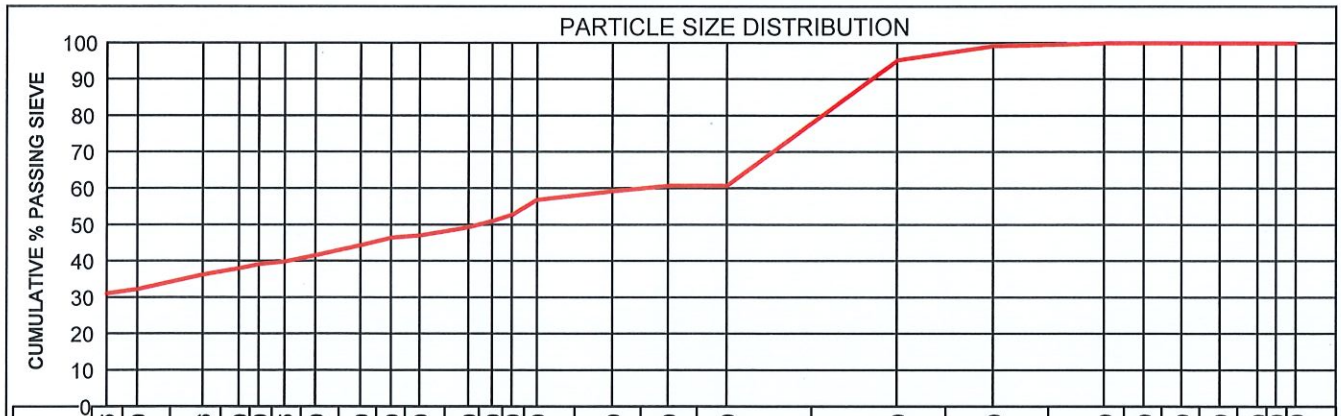
Sample No.	: 16080
Hole No.	: TP 2
Depth	: 0.60 - 3.00m
Liquid Limit (%)	: 44
Plasticity Index	: 19
Linear Shrinkage (%)	: 9,5
PI of Whole Sample	: 11
P.R.A. Classification	: A-7-6(8)
Unified Soil Classificati	: CL
Activity	: 0,34
Heave Classification	: LOW
Grading Modulus	: 0,87
Percentage (<0.002)	: 32,0
Moisture Content (%)	: 14,4

Material Description : Dark Orangey Brown to Reddish Brown SANDY CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	38,0	13,1	44,3	4,7	SANDY CLAY
Astm	38,0	18,8	42,4	0,8	SANDY CLAY
British Standard	32,2	20,5	42,5	4,7	SANDY CLAY







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	31	32	36	38	39	40	42	44	46	47	49	51	53	57	59	61	61	95	99	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL		
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks :

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

MATROLAB IS NOW PART OF SGS, THE WORLDS`S LEADING INSPECTION, VERFICATION, TESTING AND CERTIFICATION COMPANY.

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Tel. : (031) 579 1220/1
Fax : (031) 579 1344
Email : rasalis.bhikam@sgs.com

sanas Testing Laboratory T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd
17 Kingmead Drive
Westville, Durban
3629
Attention: Mr Mark Richter

Project : Mt Verde

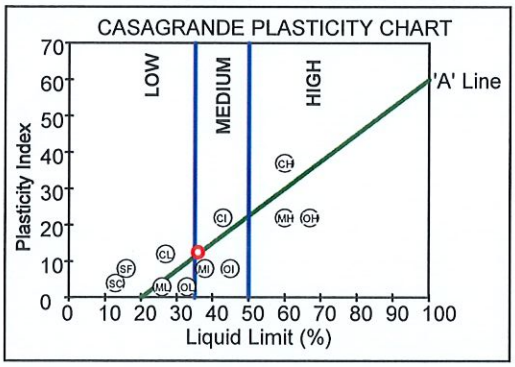
Your Ref : 22-031/1
Our Ref : 38283
Date Reported : 16.05.2022

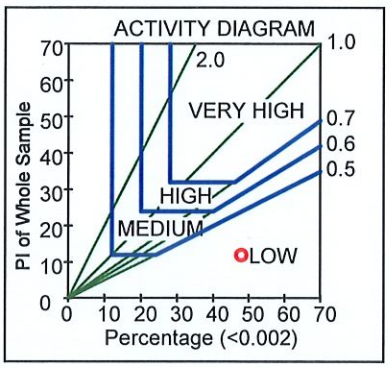
FOUNDATION INDICATOR (ASTM: D422)

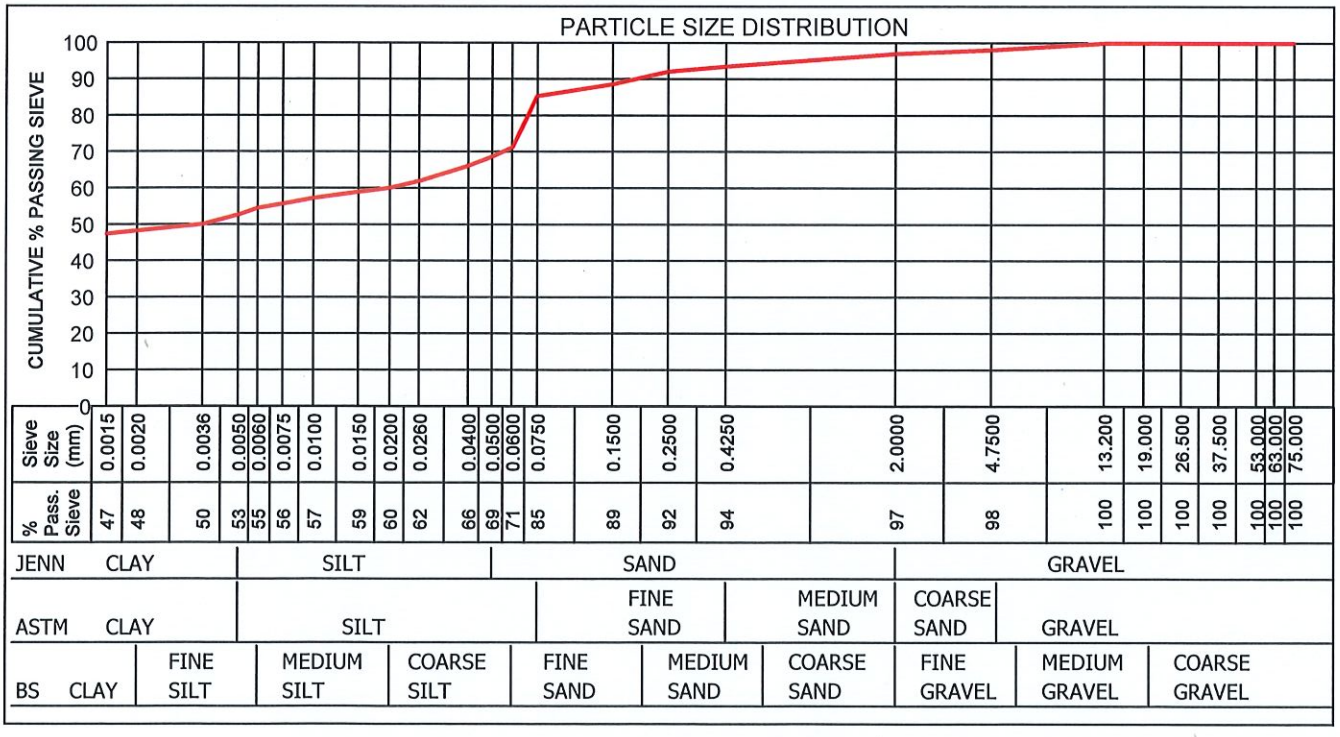
Sample No.	: 16081
Hole No.	: TP 6
Depth	: 0.00 - 1.50m
Liquid Limit (%)	: 36
Plasticity Index	: 13
Linear Shrinkage (%)	: 6,5
PI of Whole Sample	: 12
P.R.A. Classification	: A-6(9)
Unified Soil Classificati	: CL
Activity	: 0,25
Heave Classification	: LOW
Grading Modulus	: 0,24
Percentage (<0.002)	: 48,0
Moisture Content (%)	: 35,6

Material Description : Dark Reddish Brown CLAY

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	52,7	16,0	28,4	3,0	CLAY
Astm	52,7	32,7	12,8	1,9	CLAY
British Standard	48,3	22,9	25,8	3,0	SILTY CLAY







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	47	48	50	53	55	56	57	59	60	62	66	69	71	85	89	92	94	97	98	100	100	100	100	100	100	100

JENN	CLAY		SILT		SAND			GRAVEL		
ASTM	CLAY		SILT		FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL		
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks :

FORM: A6

4.4.1(SGS)(2019.12.04)

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T 0239

TEST RESULTS

Gondwana Geo Solutions (Pty) Ltd
17 Kingmead Drive
Westville, Durban
3629
Attention: Mr Mark Richter

Project : Mt Verde

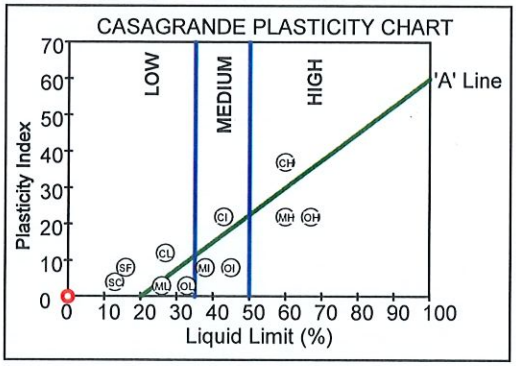
Your Ref : 22-031/1
Our Ref : 38283
Date Reported : 16.05.2022

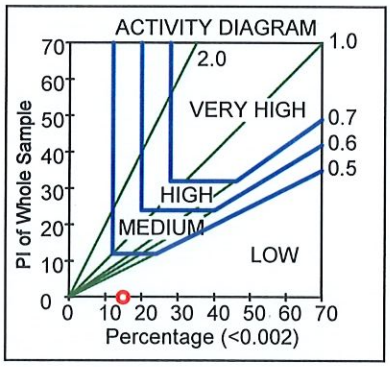
FOUNDATION INDICATOR (ASTM: D422)

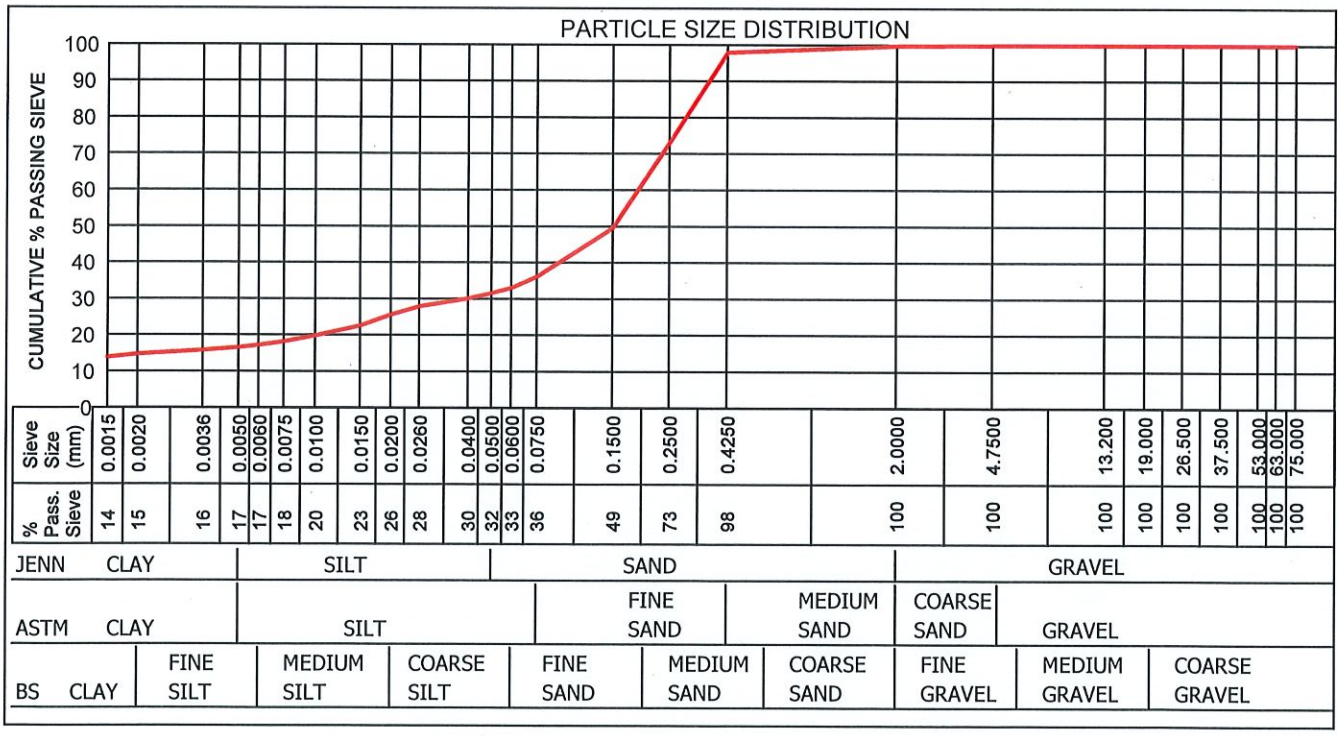
Sample No.	: 16082
Hole No.	: TP 7
Depth	: 0.40 - 3.00m
Liquid Limit (%)	: -
Plasticity Index	: SP
Linear Shrinkage (%)	: 0,5
PI of Whole Sample	: 0
P.R.A. Classification	: A-4(0)
Unified Soil Classificati	: SC
Activity	: 0,00
Heave Classification	: LOW
Grading Modulus	: 0,66
Percentage (<0.002)	: 15,0
Moisture Content (%)	: 37,3

Material Description : Light Brown SILTY SAND

	Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Classification
Jennings	16,6	14,9	68,2	0,2	SILTY SAND
Astm	16,6	19,4	63,9	0,0	SILTY SAND
British Standard	14,7	18,4	66,7	0,2	SILTY SAND







Sieve Size (mm)	0.0015	0.0020	0.0036	0.0050	0.0060	0.0075	0.0100	0.0150	0.0200	0.0260	0.0400	0.0500	0.0600	0.0750	0.1500	0.2500	0.4250	2.0000	4.7500	13.200	19.000	26.500	37.500	53.000	63.000	75.000
% Pass. Sieve	14	15	16	17	17	18	20	23	26	28	30	32	33	36	49	73	98	100	100	100	100	100	100	100	100	100

JENN	CLAY	SILT			SAND			GRAVEL		
ASTM	CLAY	SILT			FINE SAND	MEDIUM SAND	COARSE SAND	GRAVEL		
BS	CLAY	FINE SILT	MEDIUM SILT	COARSE SILT	FINE SAND	MEDIUM SAND	COARSE SAND	FINE GRAVEL	MEDIUM GRAVEL	COARSE GRAVEL

Remarks :

FORM: A6

4.4.1(SGS)(2019.12.04)

Technical Signatory : Rasalis Bhikam

APPENDIX E

Foundation design, building procedures and precautionary measures for single storey residential structures founded on expansive soil horizons. (NHBRC 1999)

SITE CLASS	ESTIMATED TOTAL HEAVE (mm)	CONSTRUCTION TYPE	FOUNDATION DESIGN AND BUILDING PROCEDURES (Expected damage limited to Category 1)
H/R	< 7.5	Normal	• Normal construction (strip footing or slab-on-the-ground) foundation • Site drainage and service / plumbing precautions recommended
H1	7.5 - 15	Modified normal	• Lightly reinforced strip footings • Articulation joints at all internal / external doors and openings • Light reinforcement in masonry • Site drainage and plumbing / service precautions
		Soil raft	• Remove all or necessary parts of expansive horizon to 1.0m beyond the perimeter of the building and replace with inert backfill compacted to 93% MOD AASHTO density at -1% to +2% of optimum moisture content. • Normal construction with lightly reinforced strip footings and light reinforcement in masonry if residual movements are <7.5mm, or construction type appropriate to residual movements • Site drainage and plumbing / service precautions
H2	15 - 30	Stiffened or cellular raft	• Stiffened or cellular raft or articulated lightly reinforced masonry • Site drainage and plumbing service precautions
		Piled construction	• Piled foundations with suspended floor slabs with or without ground beams • Site drainage and plumbing / service precautions
		Split construction	• Combination of reinforced masonry and full movement joints • Suspended floors or fabric reinforced ground slabs acting independently from the building • Site drainage and plumbing / service precautions
		Soil raft	• As for H1
H3	>30	Stiffened or cellular raft	• As for H2
		Piled construction	• As for H2
		Soil raft	• As for H1